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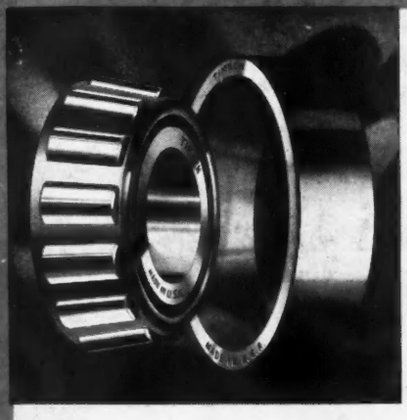

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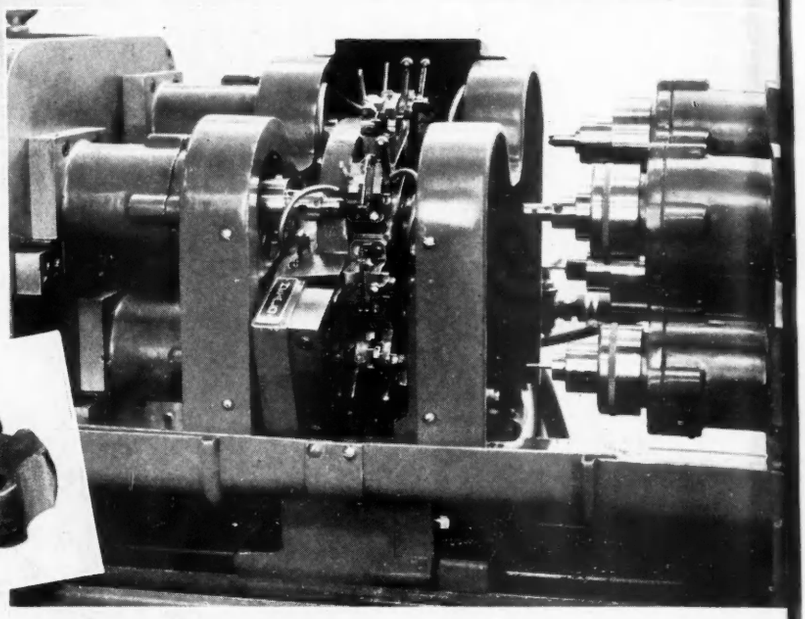
MINIMUM SCRAP

PHOTO OF PART ACTUAL SIZE



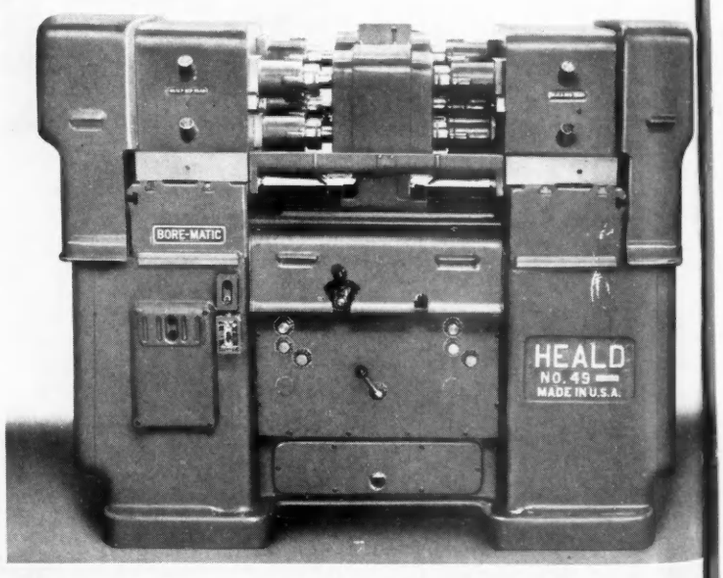
At left end of Bore-Matic followers have bosses rough and finish turned, a radius rough and finish milled. Parts at right end of machine have bosses on other side rough and finish turned, and a hole drilled and reamed.

Since installation of a Heald No. 49 Bore-Matic for finishing "arm followers" for the Garand Rifle, both production and accuracy have been greatly improved. To produce requirements formerly took three to four men. Now only one man operating one Bore-Matic is necessary. And where spoilage before was high, with the Bore-Matic, scrap is practically negligible.

Six hundred precision operations per hour are performed by this Bore-Matic. Each piece has four bosses which are rough and finish turned, one hole drilled and reamed, a radius rough and finish milled. By means of multiple tool spindles and a multi-station work fixture the machine produces a completely finished part every cycle.

All kinds of small parts like this rifle component can be finished with equally satisfactory results the Bore-Matic way. Why not, then, send us blueprints if you have an intricate machining problem on small work. The chances are we'll be able to show you that Heald Bore-Matics can save you money, can produce your small tough-to-machine parts with real precision.

Below — One completely finished arm follower is produced every cycle of the No. 49 Bore-Matic. Machine is equipped with automatic indexing fixture and multi-spindle boring heads.



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AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

Reg. U. S. Pat. Off.
Published Semi-Monthly

Volume 83 Number 12

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Automotive Industries—The Automobile is a consolidation of the Automobile (monthly) and the Motor Review (weekly), May, 1902; Dealer and Repairman (monthly), October, 1903; the Automobile Magazine (monthly), July, 1907, and the Horseless Age (weekly), founded in 1895, May, 1918.

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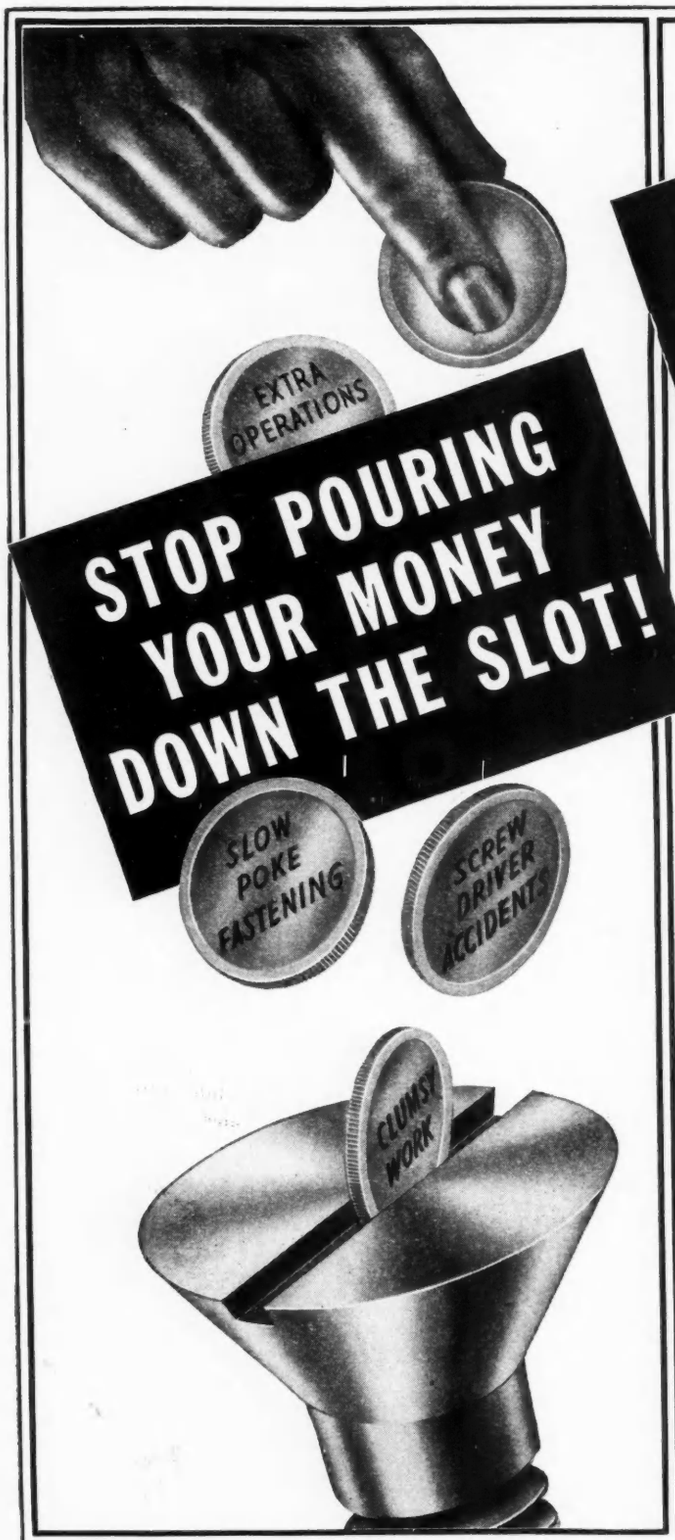

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AUTOMOTIVE INDUSTRIES

Reg. U. S. Pat. Off.

Volume 83 December 15, 1940 Number 12

GENERAL

"Little Business Gets the Green Light from Washington" 617

There is much ado about preparations now being made in the nation's capital to help the little fellows in their production of preparedness materials. In this article L. W. Moffett points out just what is being done and how to go about taking advantage of it.

AERO DESIGN

AVIATION INDUSTRIES SECTION 621

In this issue is the first of special sections for the air-minded engineers. What is new and different, advances in the field, in short, what we hope you will find of particular interest. The first of the articles describes——

Unusual Dies 621

used to form sheet metal parts of airplanes at the Martin plant. The account gives a most complete picture of production technique in one of the most modern of the country's airplane factories. There is a lot of value, not alone to the air-minded, but any who are interested in production procedures. Following this is another article of more than usual interest telling how——

Drawn Tubes Obviate Welds in the Fuselage 625

Designs have been rapidly changing, and the welded frames of the days just passed have given way to adjust themselves to the use of tapered tubing. How it is tapered, where and why, are questions that are all answered in this treatise.

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Washington Debut For Truck "Movie"

"Singing Wheels," a dramatic movie story of the part the motor truck industry plays in economic life and in the defense of the nation, was given its eastern premiere at the Willard Hotel in Washington on Dec. 3. The presentation was under the auspices of the Motor Truck Committee of the Automobile Manufacturers Association before a distinguished audience consisting of members of Congress and Government executives, including Army officers, together with representatives of the motor industry.

The picture was made by Wilding Picture Productions, Inc., Detroit, and credit for the achievement is given Dale Cox, of the International Harvester Co., chairman of AMA's Motor Truck Public Relations Committee, and Arthur D. Butler, manager of the association's Motor Truck Division. Presenting the picture was Robert F. Black, chairman of AMA's Motor Truck Committee and president of the White Motor Co.

The picture has been made available to public groups and may be obtained by communicating with the AMA Motor Truck Committee, Transportation Building, Washington, D. C.

A. C. Harvey to Handle Hobart Welder Line

A. C. Harvey Co., Allston, Mass., has been named to handle the line of Hobart "Multi-Range" arc welders, collaborating with Leo Gordon of Hobart Brothers' New England distributing office.

Houdaille-Hershey Buys Eaton Bumper Plant

Houdaille-Hershey Corp. has purchased the bumper manufacturing plant of the Eaton Mfg. Co. at Jackson, Mich. Transfer of the land and buildings which contain 102,000 sq. ft. of floor space, equipment and inventories will take place Jan. 2, 1941. C. L. Halliday will continue as general manager under the new ownership. Acquisition of this plant, which employs about 400 men, gives Houdaille-Hershey expanded bumper manufacturing facilities in addition to its other pumper plants at Detroit, Chicago and Oshawa, Ont.

New Jobbing Mill

Modernization of its jobbing mill at Ashland, Ky., at a cost of $1,000,000 has been announced by The American Rolling Mill Co. The new mills, consisting of two three-high stands and four four-high stands, will be 68-in. wide, producing 63-in. sheets.

Aftermarket Gathers For Chicago Show

Representatives of the automotive aftermarket industries converged on Chicago early this month to attend the annual Automotive Service Industries Show on Navy Pier and to be present at convention sessions of the three sponsoring organizations, Motor & Equipment Wholesalers Association, Motor & Equipment Manufacturers Association and National Standard Parts Association.

Difficult Jobs Have Made INLAND SHEETS Famous

WHEN you are faced with a tough forming job turn to Inland Sheets. They are being successfully used for extra deep draws, difficult spinning operations, deep corner draws, etc., by many leading manufacturers. Inland Sheets have become famous because they perform so well on the most difficult jobs.

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AUTOMOTIVE INDUSTRIES

Published on the 1st and 15th of the month

Vol. 83, No. 12
December 15, 1940

"Little Business" Gets the Green Light from Washington

By L. W. MOFFETT

HITCHING "little business" to the multi-billion dollar defense program has been undertaken by the National Defense Advisory Commission.

With primary defense contracts already reaching the astronomical figure of some $9,000,000,000, it has been found that while "big business" in most lines is humming at capacity operations and even expanding, there are many idle or lagging small plants together with unemployed labor, skilled as well as unskilled and also numerous "ghost towns." To mobilize the nation for total defense and to put unemployed to work, thereby removing a bottleneck in the fields of preparedness and employment, the commission has instituted a drive to engage these highly important latent forces.

The commission frowns on the habit of thinking of "big business" and "small" as separate entities, preferring that they be considered as a single unit. It is nevertheless commonly accepted that by sharing contracts with little business, both social and economic benefits result. Socially it is democratic. Economically the complete strength of industry and labor is released, healthy decentralization is brought about, purchasing power is more widely distributed geographically, and living standards throughout the country are more evenly maintained, thus avoiding the trend toward concentration of these factors in big business and in limited localities.

Those who speak of "big" and "little" business seldom have a definite conception of a line of demarcation to divide the two. "Little business" in some instances is described as an enterprise of $50,000 capital investment. In other cases the figure is set at as high as $1,000,000. But even taking the higher figure it remains a fact that there are plants coming in that category or with greater capital investment that complain of a lack of business so they are encompassed in the campaign of industrial revival.

As a neucleus to promote the campaign the defense commission has designated Donald M. Nelson, coordinator of purchases—executive vice-president of Sears, Roebuck & Co. in private life—as director of small business activities to deal with the problems of smaller business establishments in relation to the defense program. Sidney Hillman, a member of the commission in charge of its labor division—CIO vice-president and president of the Amalgamated Clothing Workers Union in private life—has been selected to revitalize the nation's "ghost towns," using idle labor and plant facilities to meet defense needs. For his assistant Mr. Hillman has Morris Cooke, well known Philadelphia industrial engineer and former head of the Rural Electrification Administration. Mr. Cooke

DONALD M. NELSON, coordinator of purchases for the defense program, says, "There must be no breakdown of the assembly lines because somewhere along the transmission belt there was a sub-contractor who lacked capital or credit with which to complete a defense order."

GENERAL

bears the title of consultant to the labor section of the defense commission.

Taking the position that small business occupies a place of vital importance in the defense program, the commission, through the director of small activities serves, among other things, as a clearing house of information for the smaller enterprises, keeping them advised of War and Navy Department requirements they may be qualified to supply. The director lends his assistance in facilitating financing required by smaller business to effectuate defense contracts. His office cooperates with local commercial banks in this connection and assists in establishing contacts with Federal Reserve Banks and the Reconstruction Finance Corp., when local banks may be unable to extend necessary credits.

The defense commission is convinced that the director of small business activities is in a position to serve as an effective liaison between War and Navy procurement officers, potential contractors, sub-contractors and local bankers so that defense contracts may be executed simultaneously with provision for adequate bank or RFC financing. The director will provide a focal point for primary contractors and potential sub-contractors in various parts of the country as a further means of implementing the commission policy to bring into the fullest possible use all available plant facilities and unused manpower in the small and medium size business sector without disrupting normal civilian requirements.

In order to decentralize the work of Director Nelson, the defense commission has obtained the cooperation of the Federal Reserve System. Its Board of Governors serves as operating agent for the commission in carrying out its program, with a senior officer designated in each Federal Reserve Bank and branch to handle all problems relating to field and technical activities.

It is the responsibility of Federal Reserve Bank officers to report on the availability of small business enterprises in their districts to participate in the defense program; to familiarize local banks with the procedure to be followed in accepting assignment of government claims as security for loans; to encourage local banks to make loan commitments on condition that borrowers obtain government contracts; to furnish business enterprises in their districts with information on the procedure relative to obtaining defense contracts; and to assist small business enterprises to obtain necessary financing from their local banks. The commission has pointed out that by utilizing the services of the Federal Reserve Banks in their own territories, the smaller business men throughout the country will be in a position to obtain promptly and accurately information they require to play their part in the defense program.

At a Washington conference, attended by 47 officers of the Federal Reserve Banks and their branches, arranged by Ernest G. Draper of the Board of Governors, Director Nelson detailed plans of dealing with the problems and interests, particularly of smaller business and industrial establishments in relation to the program. Representatives of the Treasury, Navy, War and Commerce Departments, the RFC and the Securities and Exchange Commission also attended the conference. Mr. Nelson emphasized that the future status of the commercial banking system will in large part be influenced by the manner in which local banks meet the challenge of providing finance for total defense. Representatives of other branches of the Government recited their activities, such as methods of making purchases, location of procurement centers, distribution and type of defense contracts, plant facilities contracts, etc.

In pointing to the heavy burden being placed upon the army of subcontractors who are "feeding the assembly lines for guns, tanks and planes," Mr. Nelson said. "There must be no breakdown of the assembly lines because somewhere along the transmission belt there was a subcontractor who lacked capital or credit with which to complete a defense order."

Mr. Hillman's program of revitalizing "ghost towns," to use his phrase, started in Ohio, Pennsylvania and Illinois and is spreading throughout the country.

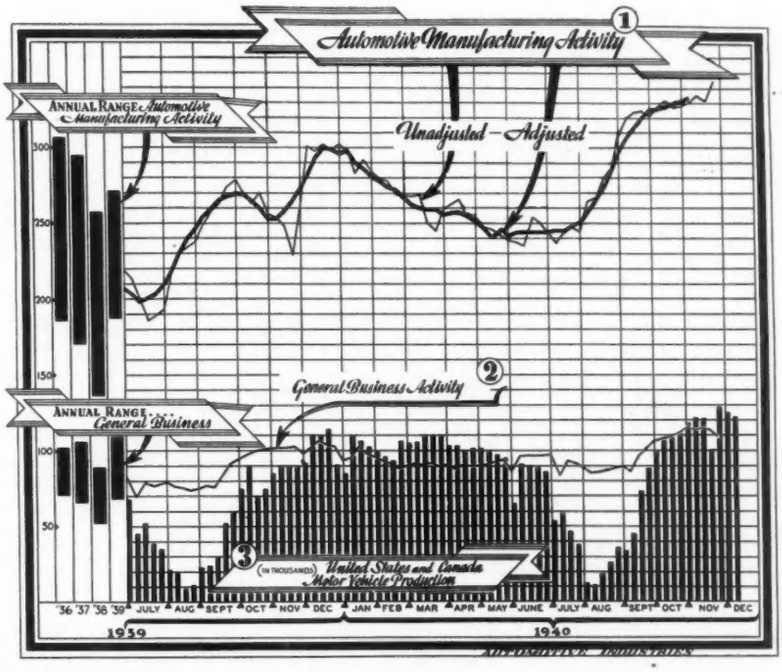
(*Turn to page* 660)

The Brass-Hat Rack

"Three times a week I park my car here and somebody sells it!"

BUSINESS IN BRIEF

Our own view of automotive production and sales; authoritative interpretation of general conditions


Automotive Manufacturing Activity
1
Annual Range Automotive Manufacturing Activity
Unadjusted – Adjusted
General Business Activity
2
Annual Range General Business
3
(In Thousands) United States and Canada Motor Vehicle Production
'36 '37 '38 '39 JULY AUG SEPT OCT NOV DEC JAN FEB MAR APR MAY JUNE JULY AUG SEPT OCT NOV DEC
1939
1940

Weekly indexes of automotive general business charted

Production Continues At Same High Level

PRODUCTION for the first half of December continued at the same high level that prevailed in the preceding two months totaling approximately 247,000 units for the first 15 days. Although the Christmas holiday together with the adverse effect of early winter weather upon sales in the northern states was expected to cut the output for the latter part of December, nevertheless the month's total was anticipated as not far short of the 469,000 vehicles produced in December, 1939. That month was the second highest December on record.

December has 21 working days compared to only 20 in November which achieved a new record for that month with an output of 514,500 vehicles, according to the estimate of the American Automobile Manufacturers Association.

Production for the week ending Dec. 7 climbed to an estimated 125,000 units, only a few hundred units less than the previous week which was the highest since May, 1937. General Motors assembled 52,600 vehicles during the week, with Pontiac, Buick and Chevrolet all working overtime shifts to supply the demand. Chevrolet produced its three-hundred-thousandth 1941 model Nov. 27.

Cadillac's November output of 5417 cars was a record for that Division. Chrysler Divisions turned out 28,100 vehicles, while Ford manufactured 27,000 units. Studebaker continued its leadership among the independents, followed by Nash, now operating at near capacity, Packard, Hudson and Willys. Nash shipped more cars to dealers in November than for any month since 1929.

Truck manufacturers such as Dodge, Chevrolet, General Motors Truck and White were supplementing their domestic business with large Government orders.

The salutary fact, however, about November sales was that used car sales showed greater proportional gains over the same month of 1939 than did new car deliveries. Chevrolet moved 163,827 used cars during the month, a gain of 39 per cent compared to an eight per cent advance in new car deliveries which totaled 96,835 units. Pontiac sold 33 per cent more used cars, while new car sales increased 23 per cent. Buick, Pontiac, DeSoto, Oldsmobile and Cadillac have set new high marks.

Buick has upped its 1941 model production goal to 350,000 cars on the basis of greater demand in the fourth quarter of 1940. Hudson shipments to dealers for the first four months of 1941 exceed such shipments for the first half of the 1940 model run.

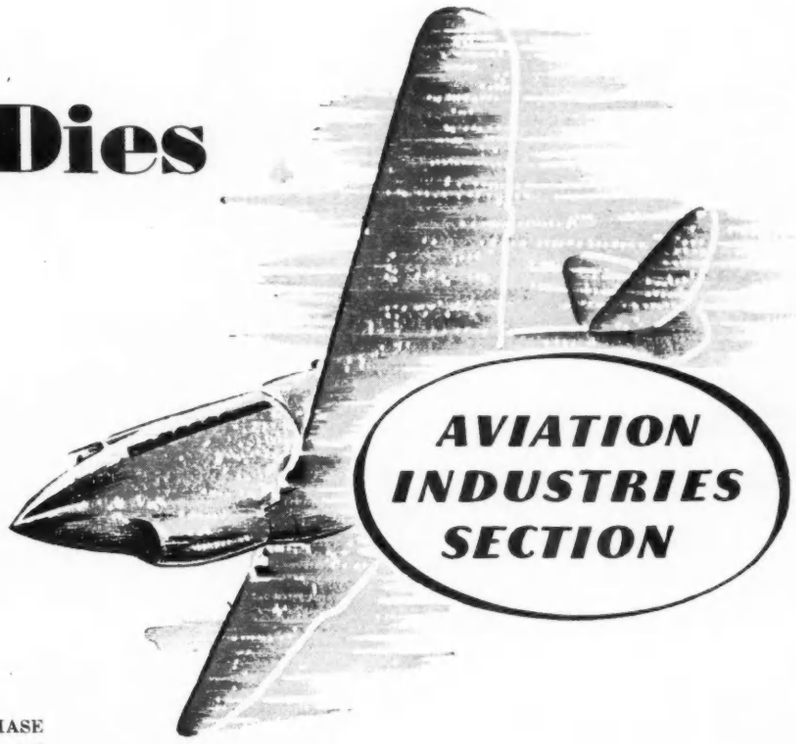
A curtailment of luxury imports to conserve foreign exchange by Canada is expected to affect shipments to the Dominion. The order prohibits importation of assembled passenger cars.

[1] 1923 average = 100; [2] Prepared by Administrative and Research Corp. New York. 1926 = 100; [3] Estimated at the Detroit office of AUTOMOTIVE INDUSTRIES.

The nation has now completed twenty years of coast-to-coast air service. The initial course was from New York to San Francisco for the U. S. Mail exclusively in converted DH4s flown by army pilots. The first coast-to-coast passenger service was inaugurated in 1928 although a combination plane and railroad service preceded it for a short period. The progress in design is shown graphically here in the four planes shown. 1. The first passengers were transported from the Atlantic to the Pacific over the No. 1 airway in single-engined Boeings in 1928. 2. Fourteen passenger Boeing tri-motors were the first multi-motored planes flown on the pioneer transcontinental airway in 1929. 3. The nation's first all-metal, low-wing, twin-engined transports were the Boeing 247s introduced to the transcontinental airway by United Air Lines in 1933. 4. Douglas DC-3 Mainliner day planes and sleepers reduced travel time between the two coasts to less than 16 hours in 1937.

Unusual Dies

are used to form sheet metal in the Martin aircraft plant



By HERBERT CHASE

METHODS used in forming sheet metal for aircraft parts differ in many ways from those prevailing in many shops devoted to forming sheet materials. This applies especially to parts which are fairly large in size and in which the quantities required do not warrant the use of steel or alloy iron dies such as are required, for example, in the production of automobile body parts manufactured in much larger numbers. It has been necessary, however, with the increasing number of aircraft required for military, naval and other uses, to abandon, as far as possible, hand-and-hammer forming and to substitute more rapid methods which, of course, are more economical. Many parts required in sufficient quantities to justify steel or alloy iron dies are stamped by conventional methods in ordinary stamping presses and the methods are so similar to those in common use that details need not be given here. Attention is centered, rather, on methods differing from the conventional and adapted especially for quantities which range, as a rule, between 100 to 1000 pieces but which are sometimes used for smaller numbers and can be adapted if necessary for much longer runs. Some of the methods used are already being employed in other plants than those devoted to aircraft construction and are deserving of note by those manufacturers faced with making similar parts in similar quantities from sheet stock similar if not identical in character.

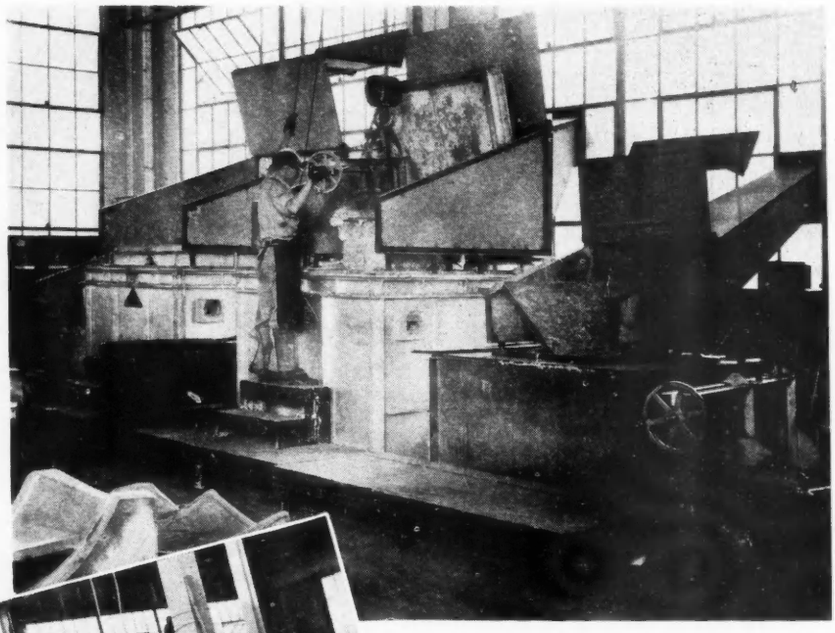
As the production in question depends in large part upon using dies of rather unconventional types, the methods by which these are made may first be outlined. A considerable number of the sheet metal parts produced are for cowlings and the "skin" of fuselages and wings, but others are for interior parts. Most of the dies used are cast from zinc alloy in sand molds very close to actual size and much of the economy realized results

Portion of the new drop hammer shop recently put in operation at the Glenn L. Martin plant. Equipment includes thirteen Chambersburg "Ceco-stamp" air-operated drop hammers which are preferred to the older rope drop hammers, seen in the background, because faster and easier to control.

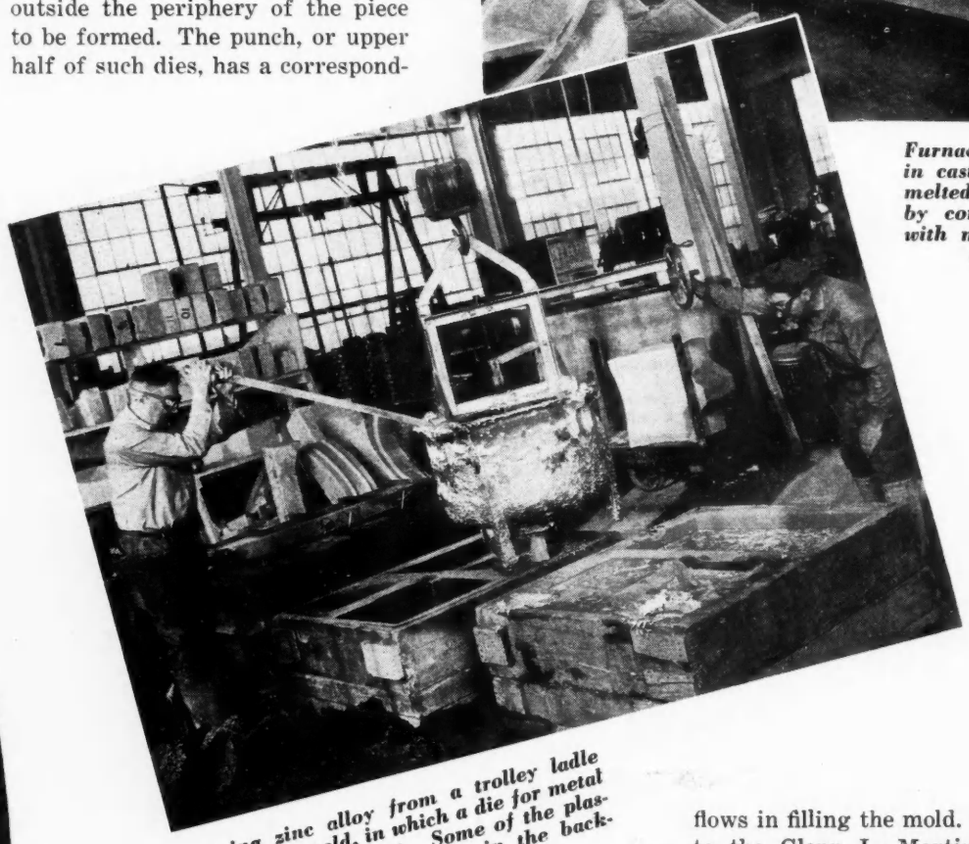
AVIATION INDUSTRIES

from the saving in machine work as compared with using steel or ferrous castings.

To make the molds for casting the dies, it is necessary, of course, to have suitable patterns. These are made from plaster of paris which is cast against a wooden form, often a "mock-up," having a surface of the same shape as that which the sheet metal part to be shaped in the die must form. Dies to be used in drop hammers and which must perform drawing operations are often provided, in the case of the lower half, with a pair of ridges near the outer edge and outside the periphery of the piece to be formed. The punch, or upper half of such dies, has a corresponding single ridge or bead which, except for the necessary allowance for metal clearance, fits the valley between the two ridges on the lower die. The function of these ridges is to clamp the metal sheet and to hold it by friction while it is being drawn by the surfaces of the die which give it the required shape. In effect, the ridges take the place of clamp rings or pressure pads used in conventional drawing dies.



Furnaces in which the zinc alloy, used in casting dies for metal forming, is melted. The melting pots are heated by contact of their exterior surface with molten lead bath maintained at the required temperature.



Pouring zinc alloy from a trolley ladle into a sand mold, in which a die for metal forming is being cast. Some of the plaster patterns used are seen in the background.

Patterns cast in plaster are given a smooth finish and are used in making sand molds very much as wooden patterns are, except that open molds are used. Men skilled in plaster working spend as much time as may be required in finishing the patterns so as to make sure that they will have the critical surfaces smooth and of correct contour, as this, of course, makes for smooth mold surfaces and for metal castings which require a minimum of scraping. Molds are provided with risers at the bottom of which is a gate through which the molten metal flows in filling the mold. Methods here described apply to the Glenn L. Martin Company practice, but are similar in many respects to those used in other aircraft plants performing similar operations.

To simplify casting procedure, dies, cast in the manner indicated, are in metal of fairly low melting point and one which affords a smooth surface on which any scraping required is done quite easily. In the past, various metals and alloys have been used. Prime Western zinc has served extensively for the purpose but is now largely superseded by a zinc alloy meeting S.A.E. specification No. 925, as this alloy is much harder and stronger, is somewhat easier to cast and results in smoother surfaces which require less work in finishing. The greater hardness makes for greater wear resistance and longer life and tends to minimize the chance of damaging the die in service. Moreover, repairing can be done, if necessary, by welding and, because of the greater strength (tensile strength, 35,-

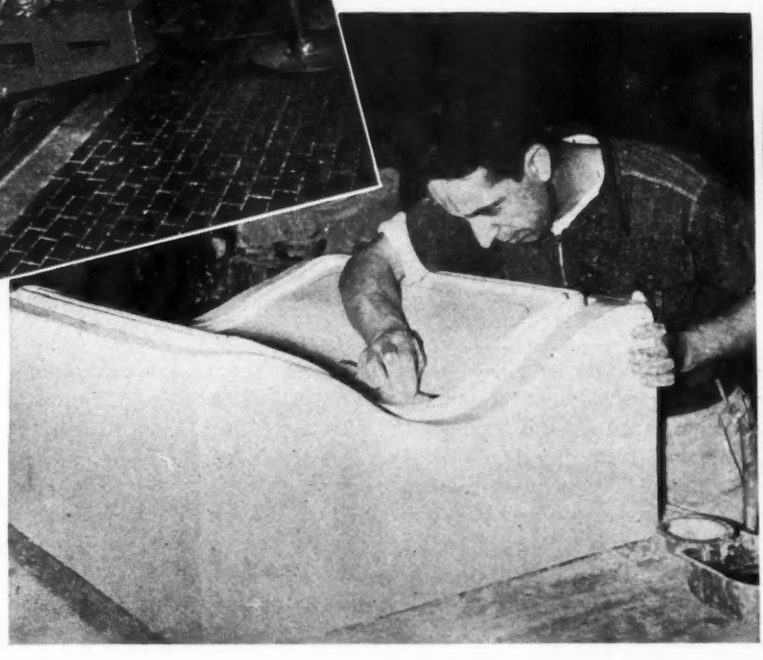
000 to 38,000 lb. per sq. in., is nearly seven times that of Prime Western), lighter dies can be used. In addition, the alloy, which contains 3.5 to 4.3 per cent of aluminum, 0.75 to 1.25 per cent of copper and 0.02 to 0.08 per cent of magnesium and the balance high-purity zinc, has much less tendency to dissolve iron than does Prime Western and this makes for longer life of pots for melting and of ladles for handling the molten metal.

In the Martin plant, melting is done in a special furnace in which the melting pot sets in a bath of molten lead which is heated, of course, to a temperature high enough to melt the zinc alloy. As the flame does not come in contact with the pot containing the zinc, the life of the pot is said to be much longer than when direct flame heating is used. The molten alloy is taken from the metal pot in a bottom-outlet ladle, handled by a trolley, and the ladle is placed as close to the mold riser as practical when the mold is filled.

After dies are cast in this manner, the riser and gate are cut off and the critical surfaces of the die are scraped to remove surface irregularities and make them perfectly smooth. Initial surfacing is done by using portable grinding wheels and the scraping is done by hand. It is not necessary, of course, to do accurate machine work, as in finishing steel or cast iron dies, and this saves much expense. Fitting of the two halves is done by bluing one half, then putting the other half in place and afterward scraping the high spots until the halves fit.

A large proportion of the dies made in this manner are used in air-operated drop hammers, not in positive presses such as are employed when steel or cast iron dies are used in conventional setups. This makes it possible to work the metal gradually, in several blows of the punch, into the shape of the die and also to vary the force of the blow so as to cause the metal to flow as desired. Many of the dies thus produced draw several inches deep. When the first and several of the following blows are struck, it is necessary, especially for deep draws, to cover the stock with rubber in the form of heavy sheets or blocks or strips. Their purpose is to start the metal to flowing as desired and, when wrinkles are formed, to work them out gradually. A single heavy blow might result in rupturing the piece or in injuring the die or both, but by doing the work gradually in several blows, and rearranging the rubber strips as required, the piece is shaped gradually and without injury. It requires, of course, considerable skill and judgment on the part of operators, who usually work with a helper on the opposite side of the press, and it may take several minutes per piece formed, especially for deep draws, but the shaping is done much faster than by hand hammering, of course, and it is

View of stretching machine when the forming of the cowling shown is practically complete. Edges of the metal are held in air-operated clamps at each side of the hydraulically operated bed (shown slightly tilted) which carries the die over which the metal is stretched. Operator at left handles the control levers for lifting the table and gages in background indicate the pressures applied to each of the two rams on which the die table is mounted.

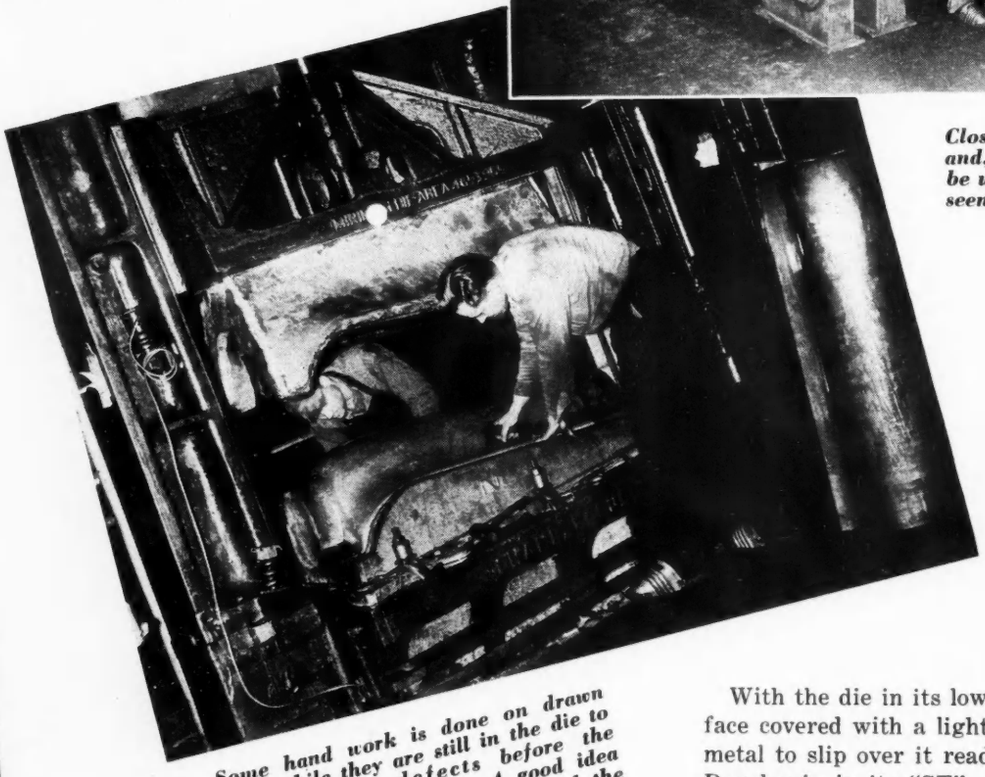


Finishing work on a pattern produced in plaster of paris. When completed, the pattern is used in making a sand mold in which the zinc alloy die is cast.

easier to hold dimensions within desired limits. Often some hand hammering is needed between strokes or following the forming operations, to remove wrinkles from flanges or other areas, but the amount of this is minimized.

Dies made from zinc alloy, as above described, are not confined in their use, however, to drop hammer work. Some are applied in an unusual if not unique metal stretching machine and some in hydraulic presses. Stretching is done in a machine built especially for the purpose by the Engineering Research Corporation and shown in an accompanying illustration on page 623. This machine has a table on which the die is placed with its working face upward, only one die, corresponding to the punch or male die in an ordinary die set, being required.

Closer view of three drop hammers and, in the foreground, zinc dies to be used in the hammers when those seen in the machines have completed their runs.



Some hand work is done on drawn parts while they are still in the die to rectify minor defects before the stamping is withdrawn. A good idea as to the size of a large die and the stamping made in it (right foreground) is here obtained.

In the stretching machine, the table is supported on a pair of heavy pivot pins each of which is carried on the upper end of a hydraulic plunger. Each of the two plungers is arranged with a separate control and for motion independent of each other. When fully lowered, the table is horizontal. If, in raising the table (to stretch the metal), the two rams are so controlled that they move upward at the same rate, the table remains horizontal; but if the rate of motion be different, the table is tilted correspondingly, or it can be rocked either or both ways if desired. The die, of course, is given the shape necessary to form the piece as required.

With the die in its lowest position and with its surface covered with a light grease, such as to allow the metal to slip over it readily, a sheet of metal, usually Duralumin in its "ST" condition, is laid over the die and the edges of the sheet are fastened securely in air-operated clamps provided for the purpose. These clamps are carried on castings anchored to the base and set approximately parallel to the edges of the die. After the clamps are locked, the operator stands at a pair of levers which control the valves for admitting hydraulic pressure to the cylinders of the rams which support the die table. As the valves are opened, the table is elevated slowly and finally pulls the sheet taut, forcing the latter to conform to the shape of the die surface as the metal is stretched. Stretching causes some flow of the metal along the die surface and the flow can be controlled, within limits, by tilting the die. The latter is curved, of course, in planes transverse to the table. It may or may not be curved in longitudinal planes, depending, naturally, on the shape of piece to

(*Turn to page* 635, *please*)

Drawn Tubing Obviates Many Welds in Fuselage

By Henry Lowe Brownback*

A REVOLUTION in the building of airplane structures occurred during the First World War when Fokker introduced the welded steel tubing fuselage in his famous D-7. Thereafter, this construction became classic for certain airplane structures including fuselages, landing gears, control surface frames and wing structures.

The use of steel tubing in the larger types of airplanes has declines as, in spite of its many advantages over most other materials for many airplane parts, seamless steel tubing as manufactured until very recently, had well defined limitations as its very process of manufacture precluded the diversity of shape and thickness necessary to many applications.

The steel tube was, in effect, a straight, thin-walled cylinder requiring applied fairing when used in exposed structures which had to be driven through the air and its mechanical application demanded various gussets, thimbles, etc., welded in place.

Recent research has produced tubes drawn, not only in a great diversity of shapes but tubes in which single lengths have a considerable degree of taper and in which a single cold-drawn tube may have several diameters and wall thicknesses. Appreciating the value which a knowledge of this recent progress has for the engineer and to get the latest data let us follow the technique of the Summerill Tubing Co., at Bridgeport, Pa., where a large percentage of the aircraft tubing is produced.

Before going into the details of the new types of tubing, it might be interesting to study the manufacture of the basic cold-drawn cylindrical tube from which all of the other shapes are derived.

The steel employed for aircraft structures is the highest grade of electric furnace steel and is, for the most part, a chrome-molybdenum corresponding roughly to S.A.E. No. X4130 but with far stricter limits on carbon, this being held to five points. The sulphur and phosphorous are held lower than in regularly available steels as there latter elements are important influences on the weldability of the steel.

The tube begins as a pierced billet which is hot rolled into a tube. The basic hot rolled tubes are cleaned, inspected and brought to the drawing mill where the first operation known as "pointing" is per-

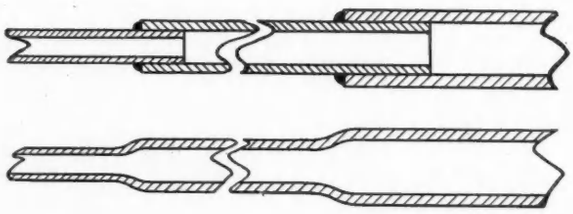
Tapered - tubing landing gear strut produced by Summerill for Stinson

AVIATION INDUSTRIES

* Summerill Tubing Co., Bridgeport, Penna.

formed. This consists of heating one end of the tube to about 1400 deg. Fahr., and forming it under a steam hammer into a long cone closed at the end. This end of the rough tube can be passed through the reducing die and be fastened to the drawing head of the "bench" as the drawing machine is called.

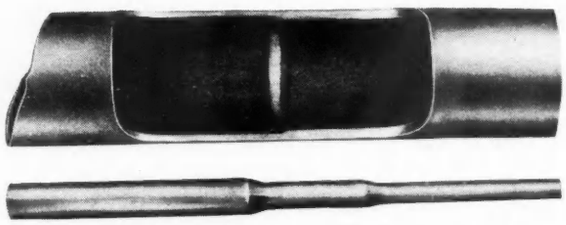
After the tube has been pointed it is annealed, pickled and lubricated, and then is placed on the draw bench. Here the mandrel or "plug," attached to a long rod, is passed inside of the tube so that it is located directly inside of the external die through which the pointed end of the tube is passed and fastened to the vise of the drawing head. The rod holding the mandrel is fixed to the machine, accurately locating the mandrel and the drawing head is started. This pulls the tube through the die and over the mandrel reducing both the diameter and wall thickness at the same time. This reduction in size and wall area is a sort of elongating operation in which the tube is lengthened about 33 1/3 per cent maximum per pass.



Top view shows the old built up and the lower drawing the new tapered technique in wing span and longeron tubes. Overlapping tubes with welds and abrupt section changes are replaced by a single tube with gradual changes in section (outside diameter and wall thickness)

This, of course, varies with the size of the tube, the quality of the steel and the finish desired. Just as a piece being machined is rough, and then finish turned, tubes are given a finish draw when high surface polish is desired and this draw is made rapidly and with little change in size.

While a considerable reduction of wall thickness and outside diameter can be accomplished in a single drawing operation, most tubes have to pass through several stages before the desired dimensions are achieved so, after a tube has been drawn to a length approximating the limit of the draw bench it must be cut in two, the back end must be pointed, both pieces annealed and the cycle repeated until the finish size is obtained. It is then straightened, cut to length,



Above—Tube with ends upset to give heavier wall. Lower—Tube tapered in three steps

normalized and cleaned ready for further processing or shipment.

There are several variations to this basic process. The first is a machine known as a "Tube Reducing Machine" which replaces the drawing bench. In this machine the rough tube is passed over a mandrel of the required diameter and over a flat die and under a reciprocating head having rolls with grooves of the same radius as the outside diameter of the finished tube. It is then fed slowly through the machine, turning slowly as it proceeds, being rolled to size by the reciprocating head. This machine will reduce wall thickness as much in one pass as several drawings on the bench.

In small tubes where it would be impossible to use the usual plug mandrel a long rod is used in its place. In order to effect the release of the rod after drawing the entire tube is passed between rolls under a slight pressure. This releases the rod and permits its withdrawal. Summerill makes stock tubing down to 0.016 in. outside diameter and 0.005 in. inside diameter. Special tubes 0.0103 in. outside diameter with a wall thickness of 0.0015 in. can be had.

These very small tubes are hand drawn using a fine wire as a mandrel and then by reducing both the outside diameter and the inside diameter by hand drawing through a wire drawing machine having a diamond die. These small tubes have highly polished surfaces and are cleaned internally with nitrogen and sealed immediately when finished.

The newer annealing furnaces are Surface Combustion, gas fired, and have a controlled atmosphere. The older furnaces are electrically heated and are provided with a hydrogen atmosphere derived from cracked ammonia.

The larger dies and mandrels are made from tool steel and the smaller ones from tungsten carbide or diamonds. Naturally all are highly polished and kept

Left—Tapered tubing landing gear fork straight and bent

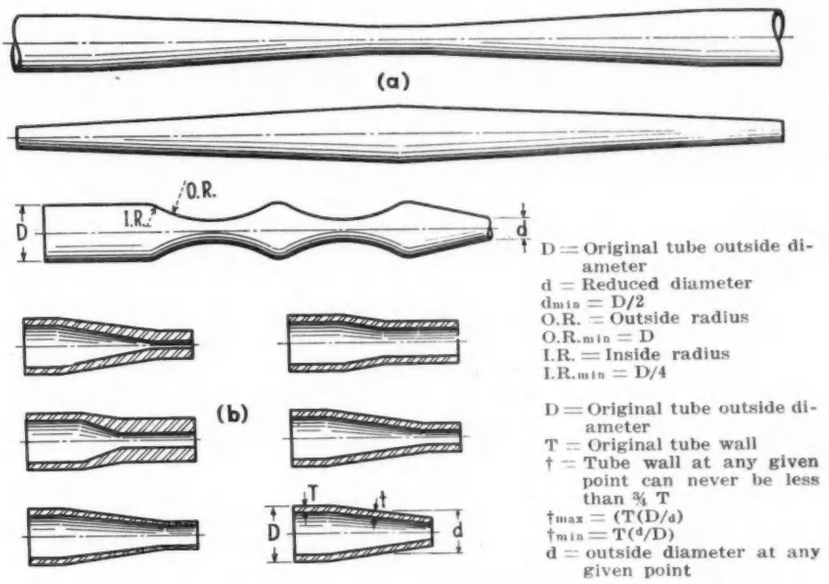
Above—Tube with double taper to be made into landing gear fork. Dotted lines show finished shape

scrupulously clean to prevent scratching the surfaces of the tube.

The drawing operations require the use of special lubricants which vary with the type of steel being used.

Having gotten a rather hurried picture of the manufacture of the basic round cold drawn steel tube, let us look over the newer developments which make the application of tubing to aircraft and other structures more advantageous than it has been in the past. Needless to say, the special shapes require special tooling and, therefore, lend themselves better to quantity production than to one-piece jobs.

It might be said here that the quantity production of aircraft by the automotive industry may radically change the present method of manufacture with its use of monocoque riveted aluminum alloy structures and go to welded structures made of steel. In this case some future development along the lines of the present manufacture of motor car bodies, where the various elements are set up in a jig and welded in one "flash," is entirely possible. In



Dimensional ratios of wall thickness and diameter that are obtainable in shaped and tapered tubing

Typical taper for Torque tube

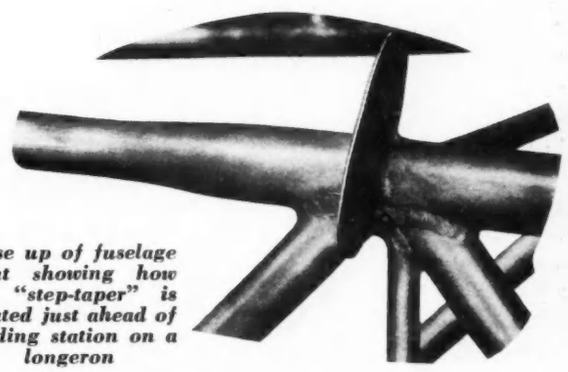
such a setup the making of an entire fuselage frame by the flash welding of a number of accurately preformed elements is a most interesting possibility.

Now let us consider only the use of tubing as part of the structure of aircraft and neglect the numerous other places where it is employed such as air, gas, oil and brake lines, control units, pressure gage Bourdon tubes, Sylphon tubes, etc. One interesting engine application of the newer type of tubing is the valve operating pushrod. These long pushrods are usually fitted with ball and socket joints at both ends and have become heavier and larger every year as ever increasing engine speeds demand increased valve spring pressures resulting in heavy column loads in the pushrod. With ordinary cylindrical sections a large diameter tube is necessary to avoid buckling and this added weight increases inertia forces requiring still stiffer valve springs.

Tubes formed with a taper from the middle toward the ends having an ideal column form are available and greatly reduce the push rod weight as well as any danger from buckling.

Another interesting application shown was that in which a single tube was employed as a fixed landing gear strut having the wheel carried on a stub axle fastened to the lower end, being attached to the fuselage through a fulcrum near the upper end and a shock absorber which lies within the body of plane is fastened to the upper end. This makes a wonderfully simple structure in which the diameters and wall thicknesses of the single member meet the load conditions and in which one section blends into the other gradually with no sharp changes in section to concentrate stresses, no welded joints, no double thicknesses, no patches or gussets.

In this connection it is well to remember that all welds have the strength of cast, not worked metal, and that the worked sheet or tubing making up composite welded structures are heated at and near the weld to a very high degree which decreases the strength of the metal at this point. Therefore, if load conditions can be met without welding or if members can be increased in thickness at the point of welding so that the use of welded patches or gussets is unnecessary, and tubular sections and wall thicknesses increased or decreased without the use of different sections of tubing welded together with fishtail or scarph joints, a lighter and stronger unit which will



Close up of fuselage joint showing how the "step-taper" is located just ahead of welding station on a longeron

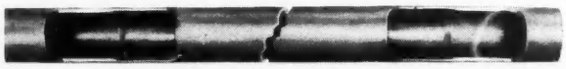
AUTOMOTIVE INDUSTRIES

Various stages in the bending of a special-double taper tube used in motor construction. Such tubes may be used as bell cranks, torsion bars, etc.

cost less and demand the use of less, difficult-to-obtain, skilled labor will result.

In order to get a fuselage or wing spar tube which met load conditions a member made up of several sizes of tubing has been used. The ends of these tubes usually telescoped and were welded. Today it is possible to draw a single length of tubing for any of these loaded members with several diameters and wall thicknesses changing gradually from one section to another and with additional wall thickness at the change, thus meeting exactly the loads imposed.

To complete many structures such as fuselages, wing frames, etc., it is necessary to weld secondary members to these long tubes. Formerly these shorter members were cut from stock lengths of tubing and often fitted with thimbles at the point of welding. Today these tubes may be obtained finished ready to weld into place with sections which meet load condi-



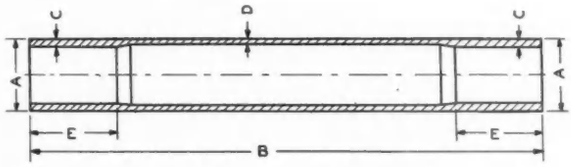
Typical tube upset on both ends to produce thicker walls. 1¾ in. outside diameter by 0.065 in. wall ends thickened to 0.110 in. wall

tions exactly and not approximately and with the ends swaged or upset to the thickness desired at the weld. A most interesting structure which forcibly illustrates the economy of formed tubes is that of a landing gear fork formerly made using eight pieces of tubing and numerous patches and gussets all welded together to form the part was replaced by a single tube 3¼ in. outside diameter by 0.156 in. wall tapered to a 2 in. outside diameter by 0.180 wall at the ends. This tube was bent to shape and normalized making a better part and effecting a net saving of approximately 20 per cent per fork in cost.

When the manufacture of streamlined tubes was begun in this country, the British practice of filling a round tube with wax and then drawing it was adopted. Later it was found that tempering the tube to a certain point and then drawing it through a simple die made a better and a smoother job.

There are so many applications for this material and tubes can be drawn, rolled, swaged or otherwise worked into such a variety of forms that it is manifestly impossible to cover more than a few in an article of this length.

In structures where sheet metal or tubes must be formed or bent they should be annealed before being welded into structures as the metal so bent contains severe cold working strains. The heat of the welding and the pull of the various members in cooling may release certain of these strains in one part or accentuate them in another causing deformation or failure which would not have occurred had the bent pieces been properly annealed after cold working. After the welding is completed the part should be normalized

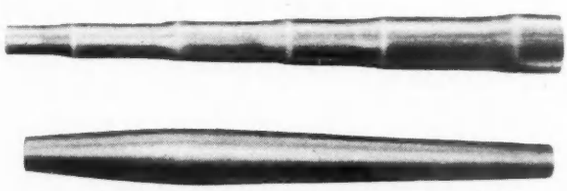


Drawing showing present size limits of tubes with upset ends

A—Up to 2½ in. approximate outside diameter
B—Up to 24 ft. length
C—80 to 90 per cent greater than D
D—0.049 in. to 0.095 in. wall, approximate range
E—According to requirements

or otherwise heat-treated. For the majority of parts normalizing will not only produce the desired physical properties but can be done at reasonable cost and much less difficulty from warpage or distortion than with quenching and tempering.

Normalizing is not only one of the simplest means of obtaining the required physical properties for X4130 steel but the benefits to the welded structure as a whole can hardly be over-emphasized. Not only is the weld metal refined in grain, strength and ductility but the annealing effect on the metal adjacent to the weld is eliminated and uniform structure and strength is obtained.



Top—Tube tapered in five steps from 5 in. outside diameter by 0.156 in wall to 2½ in. outside diameter by 0.100 in. wall. Note smooth gradual tapers at each step

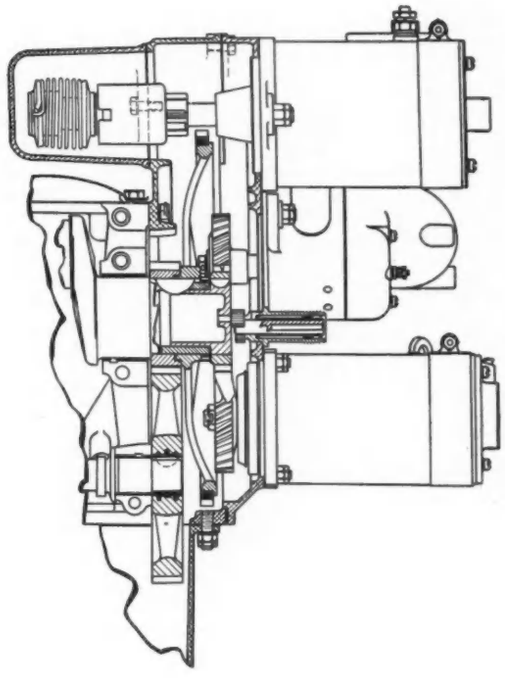
Bottom—Tube with long taper on one end and short taper on the other end (from 2¼ in. outside diameter by 0.058 in. wall to 1¾ in. outside diameter by 0.049 in. wall

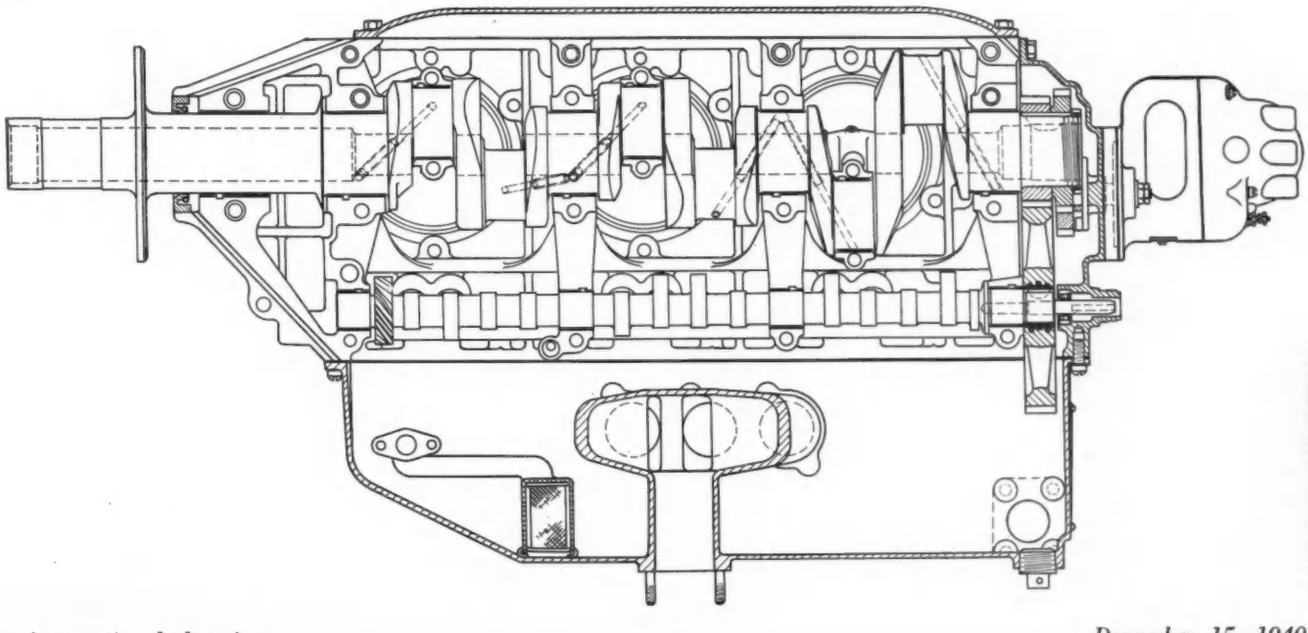
SIX-CYLINDER HORIZONTAL OPPOSED ENGINE FOR AIRPLANES

AIR-COOLED MOTORS CORPORATION has produced a six-cylinder horizontal opposed aircraft engine, of which a number of sectional assembly drawings are shown herewith. This is probably one of the first six-cylinder opposed engines ever built. In considering an engine of this type, one would ordinarily think of a three-throw crankshaft, but it is found that with such a crank arrangement it is impossible to get both uniform sequence of explosions and good mechanical balance. A six-throw crankshaft, however, as used in this engine, meets the requirements.

The new six-cylinder engine has a bore of 4 in. and a stroke of 3½ in. (264 cu. in.). It operates with a compression ratio of 7. Approved-type certificate No. 222 has been granted for this engine, certifying to an output of 117 to 120 hp. at 2600 r.p.m.

A feature of the engine is its cylinder design. A cast cylinder barrel is used, with the upper end threaded and screwed into an aluminum cylinder head. This construction has been used for some time in engines furnished by the manufacturer for the White Horse delivery vehicles. There is a triple seal for the joint between the head and barrel, viz., a snug fit at a land above the cylinder threads, a similar fit at a land below the threads, and a copper-asbestos gasket between head and barrel. Threads in the head and barrel start at definite points,





SIX-CYLINDER HORIZONTAL OPPOSED ENGINE FOR AIRPLANES

so that when the two units are screwed together at high temperature, the ports line up in a definite position with respect to the holes in the lower flange, thus eliminating any need for machining of the barrel after assembly.

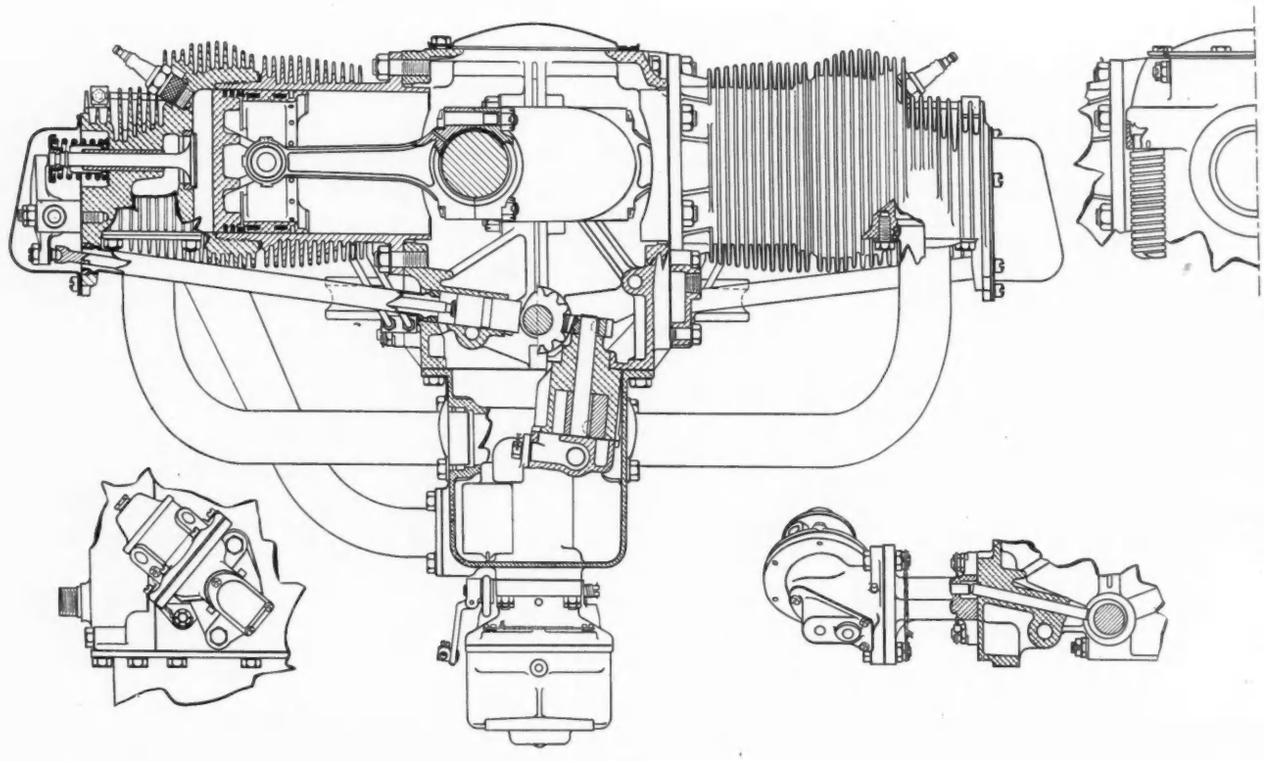
Pistons of these engines are of aluminum alloy and have steel struts cast in, which makes it permissible to fit them with a clearance of 0.003 in. at the skirt, thus eliminating piston slap. Wilcox-Rich hydraulic valve lifters are continued in this new engine. The lifter used, however, is of the new barrel type, which can be removed without dismantling the engine.

We understand that while the engine is rated at 2600 r.p.m., this is far from its peaking speed (somewhere in the neighborhood of 3700 r.p.m.). This high peaking speed is attributed to the large size of the inlet valves used, the head diameter of which is approximately 1 15/16 in. Exhaust valves are smaller and have a head diameter of 1½ in.

This engine, ready to install in the airplane, with dual magnetos with impulse couplings, weighs 248 lb. This weight includes the engine with mounting feet, rubber mounting biscuits, propeller hub, bolts and nuts, Marvel-Schebler carburetor, and breather pipe. The same engine when equipped with an Auto-Lite starter with solenoid-operated switch, Auto-Lite generator and two-stage current regulator and cut-out, with dual ignition, weighs 285 lb.

Later on this engine is to be put out also as a geared unit which is expected to develop 140 hp. at 3100 r.p.m.

A similar engine of slightly larger size, with a bore of 4¼ in. instead of 4 in., will shortly be submitted to a test for CAA approval. This larger engine has 298 cu. in. displacement and develops 138 hp. at 2600 r.p.m., and 160 hp. at 3200 r.p.m. With straight dual ignition it weighs 250 lb. and with starter and generator equipment, 290 lb.



Cadillac's New Hydra-Matic Transmission

PURCHASERS of Cadillac cars are now being offered a new Hydra-Matic transmission as optional equipment at extra cost, which will be available for delivery after New Year's. This transmission, of which a sectional view is shown herewith, is similar to the Oldsmobile transmission of the same name, which has been previously described in these columns (Nov. 15, 1939, issue), but it is larger in dimensions to allow for the greater torque of the Cadillac engine, and differs therefrom in some of its details.

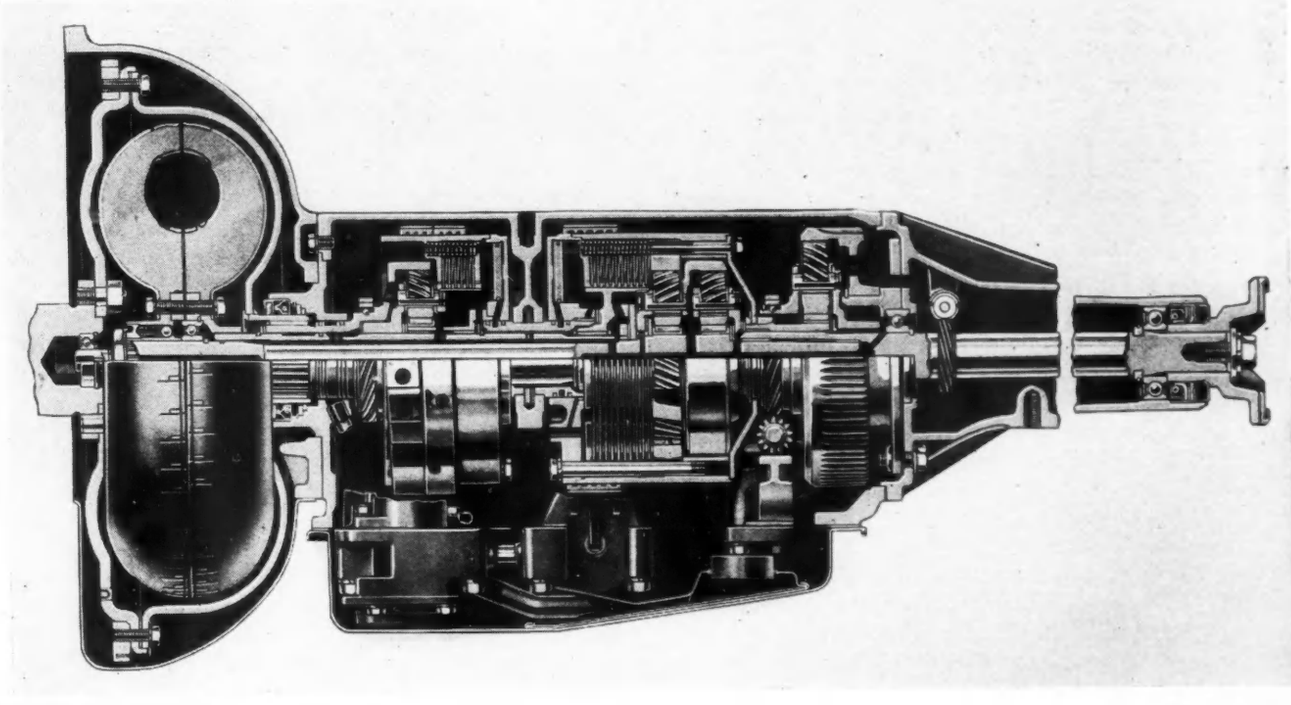
It may be recalled that the Hydra-Matic is a four-speed transmission employing planetary gear units, combined with a fluid coupling, which is used in combination with a low-reduction rear axle. Advantages claimed for this transmission are that it is completely automatic, eliminating the clutch pedal and gear-shift lever and the need for their operation; that it eliminates jerky starts, quiets the engine by lowering its speed of operation, and damps out vibration and shock. Acceleration and hill-climbing ability are increased, and the car is said to have better traction on slippery surfaces. The automatic transmission, moreover, is claimed to reduce fuel and oil consumption, and wear and tear on the engine.

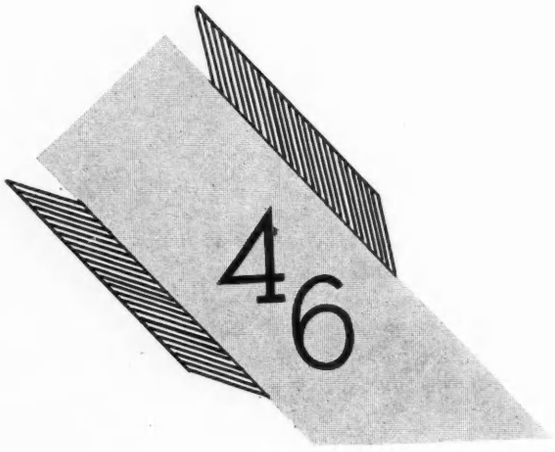
The chief design difference between the older Hydra-Matic and the new Cadillac unit is that the intermediate planetary unit, located substantially at the center of the housing, is a two-step instead of a single-step reduction gear. This unit must furnish a reduction ratio of 2.26:1, and to obtain this in a single step makes the planetary pinions rather small. By effecting the reduction in two steps, the pitch diameter of the sun pinion is reduced and that of the planetary pinions increased, which makes it possible to hold down the stresses in the teeth of the pinions.

The transmission housing is provided with a trumpet-shaped extension, a feature which has been used by Cadillac in connection with other types of transmission for a number of years to reduce the length of the propeller shaft and its tendency to whip.

The manual control consists of a small lever and indicator mounted on top of the steering column beneath the steering wheel. This indicator shows four positions—Neutral, Hi, Lo and Reverse—and it is illuminated for night driving. For all normal driving the "Hi" position is used. When the car is started in this position, the transmission shifts automatically through the four speeds. When set in "Lo," third and fourth speeds are locked out, so that the transmission remains in either first or second gear, making it possible to use the engine as a brake when descending hills.

To start a Cadillac with Hydra-Matic transmission, the operator starts the engine with the gear selector in neutral, selects the direction by placing the selector level in either "Reverse" or "Hi" position, and then steps on the accelerator.





DuPont Plastic Sheeting With Louvers

A NEW TYPE of sheeting has been developed in "Plastacele" cellulose acetate plastic made by E. I. du Pont de Nemours & Co. It comprises very thin parallel translucent louvers or "slats," either white or colored, running through the depth of a clear transparent sheet at right angles to the surface, making possible new eye comfort and bringing other previously unattainable qualities to the lighting fixture field. The material also opens new possibilities in vision control.

This sheeting, the trade name of which is "Louverglas," was conceived by L. C. Doane, president of the Doane Products Corp., and developed in collaboration with the research staff of the Plastic Department of the du Pont company.

According to the angle from which smooth-surfaced "Louverglas" is viewed, it appears as a transparent sheet with fine, parallel, translucent hair lines, which are the louvers, running through it; or as a completely translucent surface due to the louvers overlapping one another like the slats of a closed shutter; or in various proportions of translucency and transparency between these two.

In proper fixture design the sheeting appears entirely translucent within the normal field of vision, cutting off all glare. Direct light rays are confined to the area which it is desired to illuminate. With these rays penetrating, as they do, directly through the transparent section between the louvers, high light transmission is retained. In most cases "Louverglas" should be used with louvers at right angles to the length of the lamp.

A variation is embossed "Louverglas," differing only in that one surface of the plastic sheet has a prismatic finish. Forty tiny light-controlling prisms per inch serve to obscure the interior construction of the fixture, viewed from any angle; and to break up the light so that there are no eye-straining reflections or bright images. Both the prisms and the louvers are so small that neither is perceptible as such in fixtures viewed at normal distances.

For purposes where it is desired to cut off glare from all directions to the normal field of vision, one sheet of smooth-surfaced "Louverglas" may be used on top of another, with the louvers forming an egg-crate pattern. Another form of "Louverglas" combines clear transparent plastic with colored louvers, making possible for the first time color in fixtures which direct softly diffused light toward the eye, while shedding white light on the objects which it is desired to illuminate. There is no appreciable loss of lighting efficiency, as all but a negligible fraction of the light transmitted is through the clear transparent sections.

When two sheets, each with louvers of a different color, are used to make an egg-crate pattern, the sheeting color appears to change in rainbow fashion as one moves about it.

The sheeting is made in 0.040 in., 0.060 in. and 0.080 in. thicknesses, the deeper louver of the thicker sheets giving a smaller angle of cut-off. The clear transparent strips, separated by the louvers, are 0.040 in. wide. There are 24 louvers per inch.

Automotive MATERIALS

Lincoln Offers Electrode For Aircraft Welding

A NEW electrode designed and manufactured by the Lincoln Electric Co., Cleveland, expressly for aircraft structural welding is known as "Planeweld." The electrode is of the shielded arc type for welding SAE-4130 and X-4130 chrome molybdenum steels, which are widely used in airplane construction.

"Planeweld" is suitable for welding in all positions, and when used on steels of the types mentioned provides weld metal with physical properties similar to the metal welded. Its welds are smooth without undercutting. Minimum spatter and good crater conditions are claimed, and the manufacturer adds that welds made by the electrode on such steels respond to heat treatment quite similar to the parent metal. Planeweld comes in two types—Planeweld No. 1 for material

0.120 in. and heavier, and Planeweld No. 2 for light gage airplane parts (up to approximately 7/64 in.) and airplane tubing.

The new electrode is available in four sizes: Planeweld No. 1 in ⅛ in., 5/32 in., and Planeweld No. 2 in 1/16 in. and 3/32 in. It is suitable for welding airplane fuselages, tail supports, torque tubes, bomb mountings, alloy chain links, antenna mounts, chairs, etc.

McKenna Offers New Carbide Tool Material

A STRAIGHT tungsten carbide grade of Kennametal which is claimed to be approximately 15 per cent stronger than any other tungsten carbide of the same hardness, has just been placed on the market by McKenna Metals Co., Latrobe, Pa. Known as Kennametal grade K4, this new carbide tool material has a hardness of 92.0 Rockwell A and a strength of 223,000 lb. per sq. in. (transverse rupture test). The increased hardness and strength of Kennametal K4 are attributed to improved methods of carbide manufacture developed by the company for the production of the steel cutting grades of Kennametal.

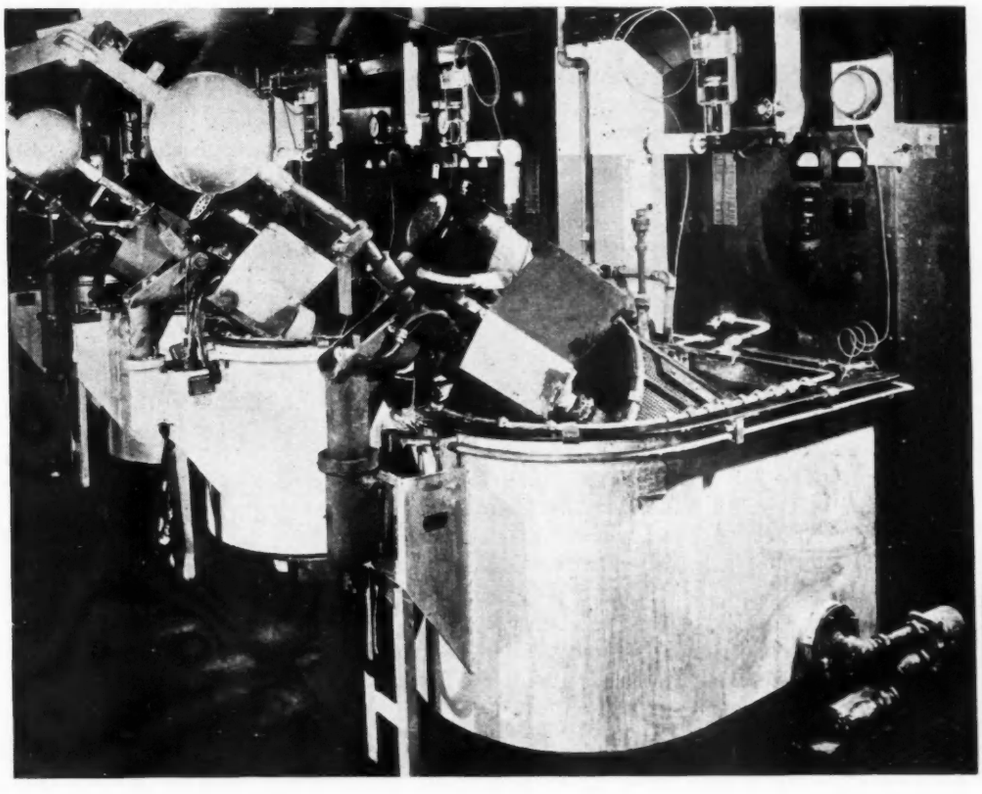
Grade K4 is particularly applicable to the machining of hard, crumbly materials such as cast iron, Bakelite, porcelain, hard rubber, glass, casein—as well as silicon aluminum, hard bronze and other nonferrous materials.

Phenolic Molding for Steering and Brake Applications

SEVERAL British manufacturers of motorcars are reported to be using molded phenolic bearing segments in various ball joints in the steering system with a view to their later application in production if tests show them to have the advantages claimed by the makers, Automotive Products Co. of London. An objective is to avoid the necessity for lubrication and presumably to make it unnecessary to grind the spherical surface of the ball as in conventional construction with metal-to-metal contacts. An accompanying sketch shows one design worked out in which four Bakelite segments are used, as indicated.

When first tried, the spherical recess surface rusted and caused the plastic surface to wear rapidly. This difficulty was overcome by chrome plating the surfaces of the recess, but this resulted in squeaking or "groaning" when the joint was moved. To avoid this trouble, the segments were molded from a shock-resisting type of material using a fabric filler (presumably finely shredded) and loaded with colloidal graphite, which provides sufficient lubrication. It was found necessary, however, to load the bearing surfaces to about 100 lb. per sq. in. to secure prolonged service without deterioration. It is stated that the molded parts require no machining before assembly.

Another innovation, reported in use (by the Lockheed Hydraulic Brake Co.), is that of molded phenolic



Closeup of one of 12 tanks for high speed electro-plating at a temperature of 180 deg. Fahr. being used in the plant of the Westinghouse Electric & Mfg. Co., Newark, N. J. Tanks are lined with the recently announced Triflex "K" rubber tank lining by The B. F. Goodrich Co., Akron, Ohio.

Triflex "K" lining comprises a layer of hard rubber construction cushioned between two layers of softer rubber, the three plies being vulcanized together to form an integral structure. Adjacent sheets of the three-ply material are overlapped to form expansion joints in which the hard rubber layers are separated, this construction permits tanks to operate with wide variations in temperature and without damage to the lining by expansion or contraction.

plungers in the wheel cylinders of braking systems, as shown in another sketch. (In this country, the plungers are usually die cast in aluminum alloy.) No graphite is used in making the plungers as the brake fluid is said to supply adequate lubrication. The plungers are necked at the outer end to receive a molded rubber seal and rubber cups are used at the inner ends to prevent any escape of fluid.

(Note: Information in hand does not indicate what if any machining is required on the molded plungers, although it is probable that some would be required to give a fit as close as that produced by centerless grinding of die cast plungers in this country. What, if any, economy or other benefits are secured by the molded plunger over those produced from metal is not stated.)

Chlorinated Rubber Coating For Concrete or Wood Floors

TRUSCON LABORATORIES, Detroit, has developed a new rubber base (chlorinated rubber) floor coating for wood or concrete floors. The coating is especially adaptable for use on cement basement floors because the material is non-saponifiable; that is, it does not react chemically in the presence of alkali and moisture, which are usually present in basement floors, or floors laid on the ground.

When drying conditions are good, Paratex will dry hard enough to walk on in a few hours. It will be oil and grease-proof in 24 hr., gasoline-proof, as well as resistant to most chemicals in 48 hr. Paratex is not affected by sunlight; therefore may be used outdoors as well as indoors.

Airco Flux-Coated Bronze Welding Rods

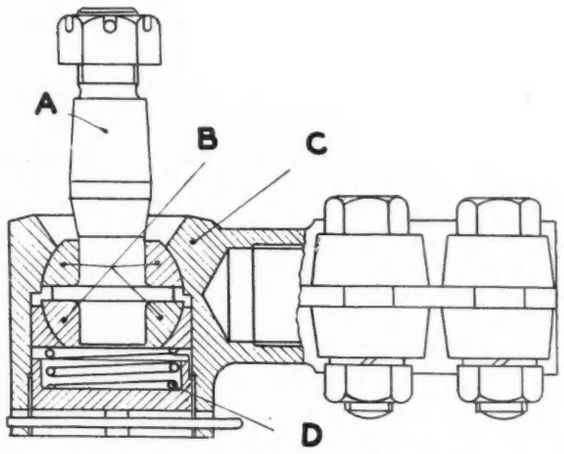
"FLUX-COATED" bronze welding rod is being offered by Air Reduction, New York. Advantages claimed for bronze welding operations are: low fuming; faster application; denser deposit; increased tensile strength; greater bond strength; increased hardness of deposit; materially improved ductility; and time saving.

For those who prefer a bare welding rod, the same flux is available in a liquid paste form.

Jessop Adds New Tool Steel To Line

A MEDIUM carbon manganese-molybdenum steel, known as 773 tool steel, has been added to the line of tool steels, made by the Jessop Steel Co., Washington, Pa. The 773 tool steel is said to possess unusual toughness, making it especially adapted for use in tools, dies, punches, cutting tools and chisels, and for a variety of applications where exceptional toughness in thin sections, as in step-down dies, spatulas, scraper knives, putty knives, is required. A ¼-in. section in the hardened and drawn condition (Rockwell C-58) will take a permanent set without cracking or bending.

The Jessop Co. also has extended its production of special alloy steels for the aircraft industry to include heat-treated and cold-drawn annealed bar products. The manufacture of Jessop aircraft steels was confined formerly to sheets and plates. S.A.E. steels of the various alloy series, such as 2300 X4130, 4340, are supplied now in bar form to meet the physical requirements for such parts as bolts, U-bolts, studs and other stressed parts.



Section through ball joint, showing how the four phenolic molded segments are applied and preloaded.

A—Steel pin.
B—Four Bakelite segments forming ball.
C—Steel housing with chrome-plated interior.

New Houghton Series Of Rust Preventives

A NEW series of rust preventives, including liquid rust-inhibiting non-drying products built from a newly developed base, has been announced by E. F. Houghton & Co., Philadelphia. The new basic material provides, states the manufacturer, a homogeneous film, non-crystalline, with a high degree of cohesion as well as adhesion to metal. It wets out the surface rapidly, making a "non-tacky" unbroken film impervious to atmospheric conditions.

New Gasket By Chrysler

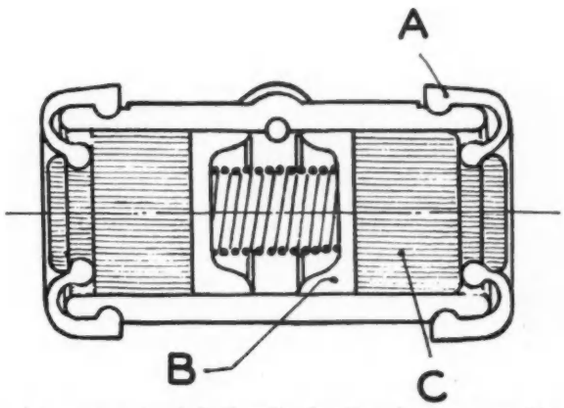
CHRYSLER CORP. engineers have developed a new type of gasket material—a synthetic rubber composition (Ligno-Neoprene)—as a substitute for cork gaskets. All materials required for the gasket are available in this country. In Chrysler cars three types of gasket materials are used: 1. Metallic asbestos gaskets, for strength and sealing at high pressures; 2. Thiokol paper gaskets, for sealing at low compression; and 3. the new synthetic rubber composition gaskets (Ligno-Neoprene) to fill the places where both resiliency and sealing are required.

Western Union Offers Recording Paper

TELEDELTOS—dry, electro-sensitive recording paper which makes practicable facsimile telegraphy—is now available for public use according to the West-

ern Union Telegraph Co., New York, N. Y. Teledeltos paper has definite advantages for many purposes because it requires no developing, processing or fixing, and records made upon it are available instantly. It is an electrically conducting sheet of paper coated with material which shows permanent changes of color at any point where an electric current passes through the sheet. The current is applied to the coated side of the paper through a metal stylus and the circuit is completed to a metal cylinder back of the paper. Neither the coating of the paper nor the record is affected by light or atmospheric conditions.

The new paper was developed by Western Union engineers seeking a suitable medium for the facsimile recording of telegrams, pictures, diagrams and other matter transmitted over telegraph lines, without the necessity of developing or otherwise processing the received record. The dry-recorded telegrams received on this paper are ready for immediate delivery on arrival.



Arrangement of hydraulic brake plungers, molded from Bakelite, as applied in a British design.
A—Rubber molding to retain leakage and exclude dirt.
B—Rubber cup seal.
C—Bakelite plunger in wheel cylinder of Lockheed hydraulic brake.

Improved Grade of Metal-Cutting Alloy

"HAYNES STELLITE" Star J-Metal is the latest cobalt-chromium-tungsten metal-cutting alloy to be announced by Haynes Stellite Co., a unit of Union Carbide & Carbon Corp. Star J-Metal is recommended by the manufacturer for all machining operations now being performed with the original "Haynes Stellite" J-Metal tools—on cast iron, semi-steel, steel, or other materials. The new tools can be operated under the same conditions as the original grade and are ground with the same wheels, at the same wheel speeds and feeds. Tool life between grinds is, however, substantially longer. In some cases, too, the increase in cutting quality makes higher cutting speeds and feeds possible.

Haynes Stellite Co. has substituted the new metal for the old grades of "Haynes Stellite" J-Metal tools. The new alloy is available in all of its manufacturer's standard tool bit sizes, both squares and flats, and in the many standard and special blade designs and sizes; also in the form of standard welded tip tools and in the many special tool designs for grooving, cutting off, counterboring, spot facing, form cutting, core drilling, etc.

Unusual Dies Used to Form Sheet Metal

(*Continued from page* 624)

be formed. Crowning the die longitudinally, so that it is higher in the center than at the ends, results in stretching the sheet progressively from the center toward the ends and this requires less pressure than if the whole sheet were stretched from end to end at one time. But progressive stretching can be done with dies having cylindrical or conical surfaces, for example, by giving the table a suitable tilt. Limit switches are so placed, however, that the table cannot be elevated too far and the sheet thus be stretched unduly or perhaps ruptured. Stretching time averages around two minutes per piece, including set-up and removal of the piece.

There are, of course, limitations as to the shapes which it is feasible to stretch, but the process is well suited to making large cowling parts which it would be difficult if not impossible to make with equal economy by other means, tooling costs being considered. Some parts have been produced in the stretching machine using forms built up from hard wood. This is said to be satisfactory when perhaps 20 parts or thereabouts are required but for much larger numbers and where closer dimensions must be held, the metal form or die is much preferable. Naturally, there is some waste of metal where the sheet is clamped, but the same is true of parts produced in drop hammers, as these, too, require trimming after shaping. Although stretching appears to be a simpler and perhaps a cheaper method of production than that effected with drop hammers for parts of certain shapes, it is not applicable for most shapes produced in drop hammer dies.

The preparation of blanks having straight edges is often performed in brakes and straight punching is frequently done in the same machine, which is used also, of course, for forming (bending over) straight flanges. Such operations are not unusual or peculiar to aircraft work, however, and need not be described in detail here. From the foregoing description, however, it is evident that the aircraft plant has already made rapid strides in its efforts to adapt itself to the working of sheet metal as rapidly as the quantities produced and the high quality of work required admit of doing.

Bearing Loads Due to

By ADIEL Y. DODGE*

WHEN power is being transmitted through a Cardan joint (two yokes, a spider and two pins) from one shaft to another not in line with it, rocking couples are created in the planes of the yokes, which add to the bearing loads and impose bending stresses on the shafts on which the yokes are mounted. These couples act around the point of intersection of the axes of these shafts. Bearing loads thus created vary from zero to the maximum (or vice versa) during 90 deg. of shaft rotation, and the shaft stresses pass through a cycle during the same period as the bearing loads.[1]

In the following mathematical discussion the friction at the trunnions of the joint will be neglected, as anti-friction bearings are now commonly used, and the friction of such bearings is negligible so far as the effects here considered are concerned. To distinguish this couple—which acts in the plane of the yokes—from the torque which is normally being transmitted by the joint, we will refer to it as the secondary couple.

* Mechanics Universal Joint Division, Borg-Warner Corporation.

[1] These bearing loads and shaft stresses are really more important in industrial than in automotive applications, because of the greater angles between shafts in the former.

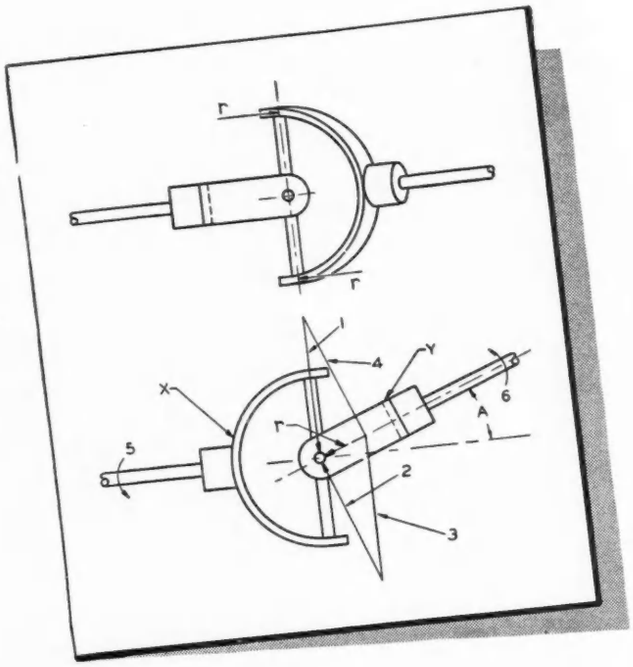


Fig. 1

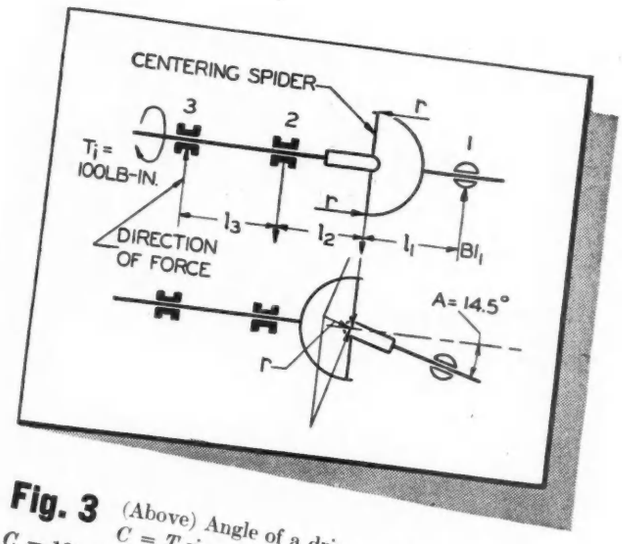


Fig. 3 (Above) Angle of a driven yoke = 90 deg.

$C = T \sin A \sin a$

$C = 100 \times 0.25 \times l = 25$ lb-in.

Bearing loads B are a maximum when the plane of the yoke is at 90 deg. to the plane through the two shafts.

$B_1 = 25$ lb-in./l_1 in. or $T \sin A \sin a/l_1$

$B_3 = (25$ lb-in./l_1 in.$) \times (l_2/l_3)$ or $(T \sin A \sin a/l_1) \times (l_2/l_3)$

$B_2 = (25$ lb-in./$l_1) + B_3$

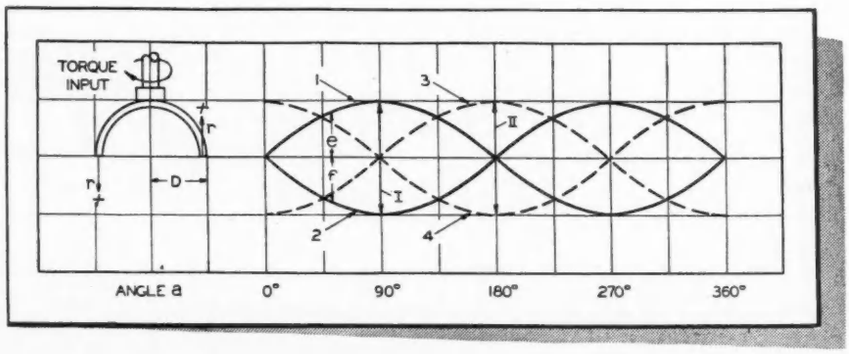


Fig. 2 (Left) Cardan joints. Secondary couple characteristics.

Universal-Joint Action

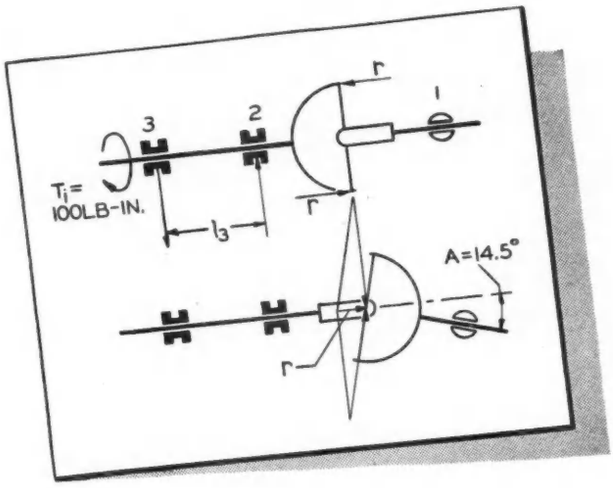


Fig. 4 Driving Yoke 90 deg. to Plane of Shafts

$C = T \tan A \sin a$

$C = 100 \times 0.2586 \times 1 = 25.85$ lb-in.

$B_1 = 0$, since this bearing is self-aligning; if it is not self-aligning the loads on the different bearings are indeterminate.

$B_2 = 25.86/l_3$ or $(T \tan A \sin a)/l_3$

$B_3 = B_2$, except that it is opposite in direction.

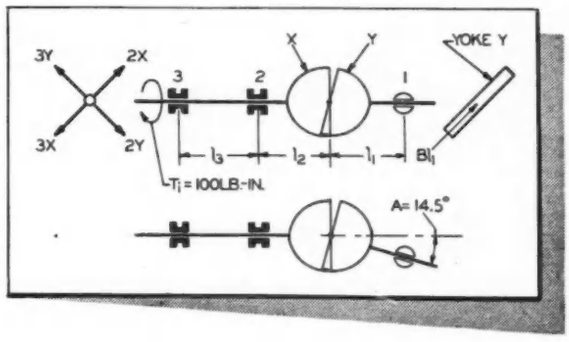


Fig. 5 Yokes 45 deg. to Plane of Shafts.

$C_x = T \tan A \sin a$ (driving yoke)

$C_y = T \sin A \sin a$ (driven yoke)

$C_1 = 18.3$ lb-in. $C_2 = 17.7$ lb-in.

B_1 (self-aligning) $= 17.7$ lb-in./l_1

$B_{3y} = (17.7/l_1) \times (l_2/l_3)$

$B_{3x} = 18.3/l_3$

$B_{2y} = (17.7/l_1) + B_{3y}$

$B_{2x} = 18.3/l_3$

Torques and couples, of course, are measured in the same units, lb.-ft. or lb.-in.

By analysis and tests we have found that the secondary couple on the driving yoke acts in the plane of this yoke and is given by the expression

$$T_i \tan A \sin a,$$

where T_i is the torque on the driving yoke; A, the angle between the axes of the connected shafts, and a, the angle of rotation of the driving yoke measured from the point when the plane of the driving yoke coincides with the plane of the two shafts. The secondary couple on the driven yoke is in the plane of the driven yoke and is equal to

$$T_i \sin A \sin a.$$

It must be remembered in this connection that if the torque on the driving shaft is constant, that on the driven shaft fluctuates. A study of the diagrams will show why the couple on the driving shaft varies as the tangent and that on the driven shaft as the sine of the angle between shafts.

In the following discussion let

T_i be the input torque in lb-in.;

T_p, the torque on the propeller or connecting shaft;

F $(=T/2D)$, the load on each trunnion;

D, the distance from the center of the joint to the

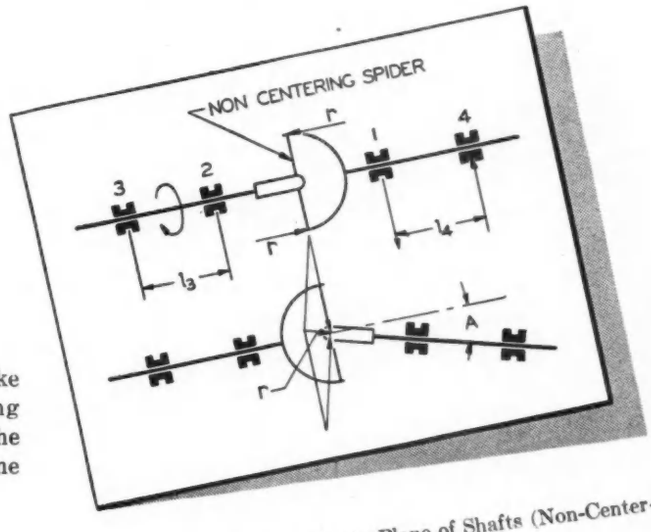


Fig. 6 Driving Yoke in Plane of Shafts (Non-Centering Spider).

$C = T \sin A \sin a$

B_1 (and B_4) $= (T \sin A \sin a)\ /l_4$

B_2 (and B_3) $= (T \sin A \sin a)\ /l_3$

Since $\sin a = 0$ for the driving member.

B_2 (and B_3) $= 0$

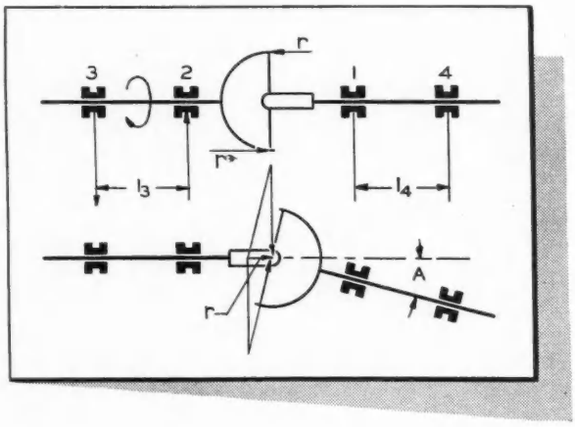


Fig. 7 Driving Yoke 90 Deg. to Plane of Shafts
$C = T \tan A \sin a$
B_2 (and B_3) = $(T \tan A \sin a) / l_3$ (sin $a = 1$)
B_1 (and B_4) = $(T \sin A \sin a) / l_4$ (sin $a = 0$)
B_1 (and B_4) = 0

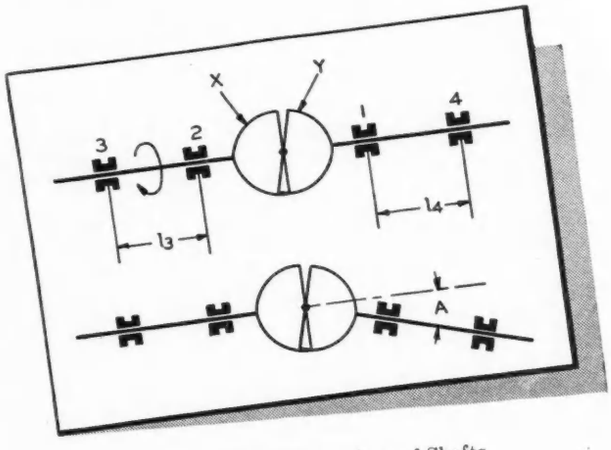


Fig. 8 Yokes 45 deg. to Plane of Shafts
$C_x = T \tan A \sin a$ (sin $a = 0.707$)
$C_y = T \sin A \sin a$ (sin $a = 0.707$)
B_2 (or B_3) = $(T \tan A \sin a) / l_3$
B_1 (or B_4) = $(T \sin A \sin a) / l_4$
(Forces on the bearings are in the planes of the respective yokes)

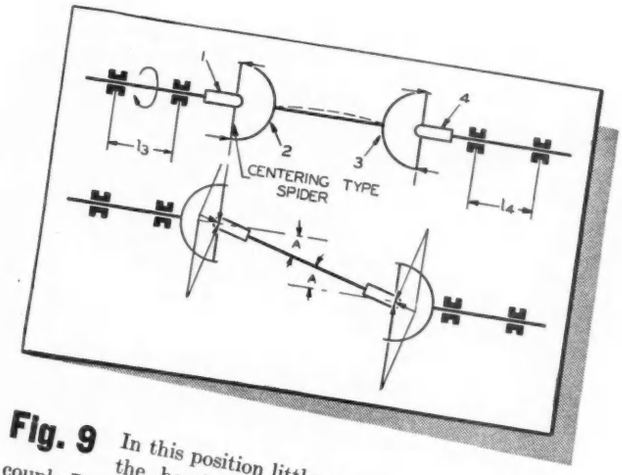


Fig. 9 In this position little or no load is imposed on the bearings by secondary couples. These couples tend to bend the propeller shaft, and the couple on the second yoke is absorbed by the third yoke.
C on second yoke = $T_i \sin A \sin a$ (sin $a = 1$)
C on third yoke = $T_p \tan A \sin a$ (sin $a = 1$)
$T_p = T_i \cos A$ in this position.

center of the trunnion bearing in in.;
R, the resistance in lb.;
A, the angle by which the shafts are out of line;
C, the secondary couple about an axis through the center of the joint, which results in a bending moment on the shaft and in additional bearing load;
r, the resultant of F and R, which lies in the plane of the yoke;
a, the angle of rotation. (sin a is equal to 1 when the plane of the yoke makes an angle of 90 deg. with the plane of both shafts; to 0.707 when the plane of the yoke makes an angle of 45 deg. with the plane of the shafts, and to O when the plane of the yoke coincides with the plane of both shafts.)

In Fig 1, arrow 5 indicates the direction of the input torque and arrow 6 the direction of the resisting moment or torque load; X, the driving yoke and Y, the driven yoke. Lines 1, 2, 3, and 4 form the sides of a parallelogram of forces. We will assume that 1 represents the force F (trunnion load) when X is the driving yoke; that side 2 represents the resistance R ($= F \cos A$ in the case represented in the diagram, where the plane of the driving yoke coincides with the plane of the two shafts). Since we start with force F, it may be considered the unit force in the triangle l-r-4, which gives,

$$r = F \sin A.$$

There is another force r at the opposite trunnion and acting in the opposite direction, and the couple in the plane of yoke Y therefore is

$$C = 2\ r\ D.$$

Substituting the value found for r above,

$$C = 2\ F\ D \sin A,$$

and substituting for D its value from the equation given in the definition of F,

$$C = 2\ F\ (T/2\ F) \sin A = T_i \sin A$$

when the plane of the driven yoke makes 90 deg. with the plane of the two shafts.

In the foregoing we have considered yoke X as the driving and yoke Y as the driven one, in which case

$$\text{Side 2} = \text{side 1} \cos A.$$

This checks with the geometry of the diagram, and the length of line 2 also checks with the output torque that might be expected.

Now consider Y to be the driving member and that the force applied to it, represented by side 2, is a unit force. Then

$$\text{Side 1} = \text{Side 2}/\cos A.$$

Now,

$$r = \text{Side 2} \tan A.$$

This checks with the geometry of the diagram. Also, the length of line 1 checks with the output torque that may be expected. Therefore,

$$C = T_i \tan A$$

when the plane of the driving yoke makes an angle

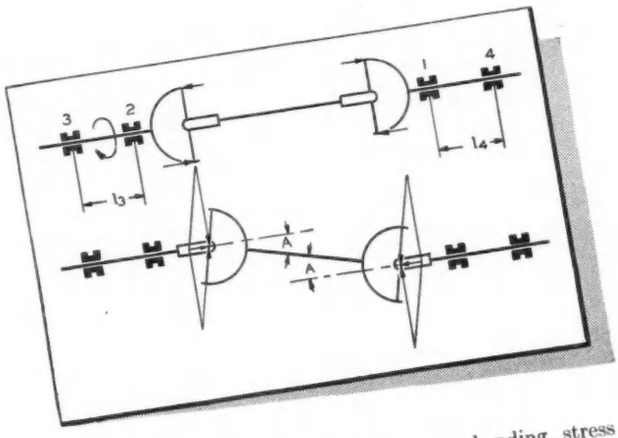


Fig. 10 In this position little or no bending stress is imposed on the propeller shaft.
B_2 (and B_3) = $(T \tan A \sin a)/l_3$
B_1 (and B_4) = $(T_p \sin A \sin a)/l_4$
$T_p = T_i \cos A$ in this position.
Sin $a = 1$ for first and fourth yokes in this position.

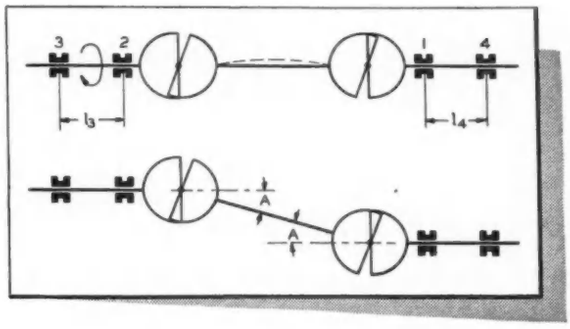


Fig. 11 $a = 45$ deg., sin $a = 0.707$
C (bending shaft) = $T \sin A \sin a$
B_2 (or B_3) = $(T \tan A \sin a)/l_2$
B_1 (and B_4) = $(T_p \sin A \sin a)/l_4$
$T_p = T_i$ in this position.
Forces imposed on the bearings lie in the planes of the yokes (see Fig. 5).

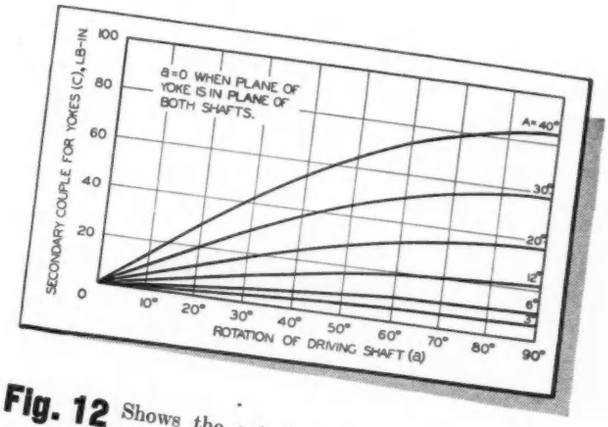


Fig. 12 Shows the actual values of the secondary couples for an input torque of 100-lb-in., various angles by which the shafts are out of line, and various angles through which the driving shaft has turned from the zero position, in which latter the driving yoke is in the plane of the two shafts.

of 90 deg. with the plane of the two shafts. This shows that the tangent must be used for the driving yoke and the sine for the driven yoke.

The secondary couple is a maximum when the yoke under consideration is at 90 deg. to the plane of the shafts. It can be readily seen that the couple is equal to zero when the plane of the yoke under consideration coincides with the plane of the shafts. Thus we have a variable which varies from 0 for an angle of 0 deg. to a maximum for an angle of 90 deg., in accordance with the sine of the angle. Therefore, for angles other than 90 deg. the expression for the secondary couple becomes

$C = T_i \tan A \sin a$ for the driving yoke, and
$C = T_i \sin A \sin a$ for the driven yoke.

In case there is another yoke at the other end of shaft 6, this must be considered the driving yoke of the next joint. This, however, is subject only to the torque on shaft 6 and not to the input torque of the first joint, which is equal to that on shaft 5.

T_p becomes a maximum when the driven yoke (the second yoke) is in the plane of the shafts. It becomes equal to T_i for an angle $a = 45$ deg. and a minimum when the driven yoke is at 90 deg. to the plane of the shafts.

$T_p = T_i \sec A$ when the driven yoke is in the plane of the shafts.

$T_p = T_i$ when the driven yoke is at 45 deg. to the plane of the shafts.

$T_p = T_i \cos A$ when the driven yoke is at 90 deg. to the plane of the shafts.

For any angular position S of the driving yoke, measured from the position in which the driving yoke makes an angle of 90 deg. with the plane through the two shaft axes, the propeller-shaft torque is given by the equation

$$T_p = \left[\sec A \left(\frac{1 + \cos^2 A \tan^2 S}{\sec^2 S} \right) \right] T_i$$

In Fig. 2 angle $a = 0$ when the plane of the driving yoke coincides with the plane of the shafts. The variables e and f show how the secondary loads r on the trunnions vary. Since the distance $2D$ is constant, the secondary couple C on the driving yoke is represented by a variable I extending between the solid-line curves 1 and 2. The secondary couple on the driven yoke is represented by a variable II extending between the dotted curves 3 and 4. Curves showing the actual values of the couples are given in Fig. 12. The direction of the secondary couple on the driven joint is opposite to that on the driving joint.

It may be pointed out in this connection that the ordinates of the curves for the secondary couple in Fig. 2 vary with the torque applied to the joint, whereas the well-known velocity curve does not change with the torque. The variations of the secondary-couple curve are a characteristic of the Cardan joint. This curve has the same period as the velocity curve, but there is a phase difference of 90 deg. between the two.

(*Turn to page 654, please*)

At the right is shown the Hydraulic Press Mfg. Co.'s new plant at Mount Gilead, Ohio, which is now in full production on high-speed, self-contained presses. Two 50-ton and two 15-ton cranes have been installed for handling heavy castings and forgings to and from basic production equipment and the assembly department.

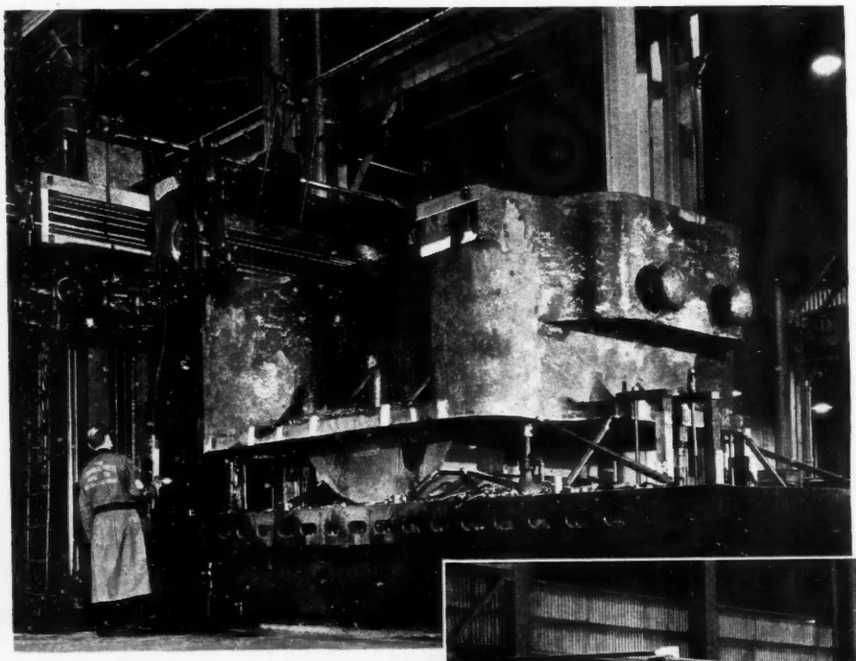
MEN

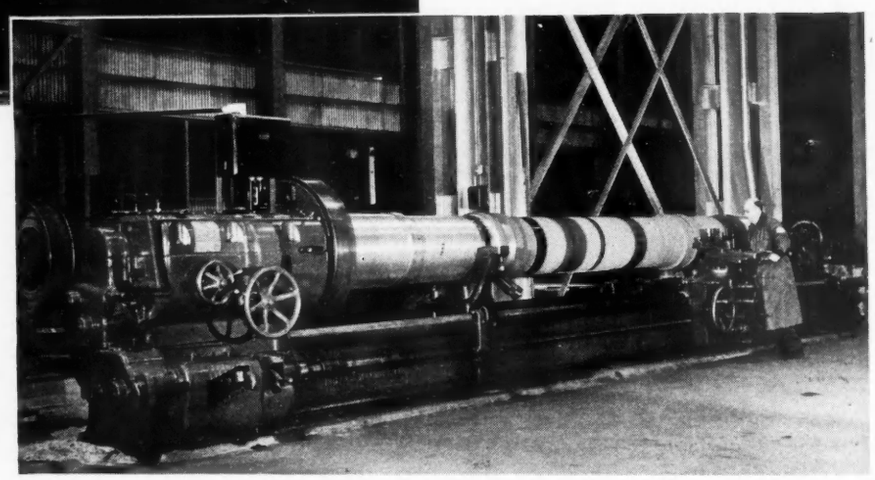
By H. E. BLANK, JR.

STRAIGHT-LINE production is applied in the building of HPM "Fastraverse" presses for aircraft, automotive, general metal-working and process industries at the new No. 2 plant of the Hydraulic Press Mfg. Co., Mount Gilead, Ohio, which is now in full operation. While total floor space has been increased only by about one-third, new machine tools, modern handling equipment and the elimination of back-tracking have not only doubled the company's capacity for press manufacture, but will enable it to triple production of its standard line of plastic injection molding presses and "Hydro-Power" pumps, controls and power units at plant No. 1.

The means by which a 100 per cent increase in capacity was attained with a one-third increase in floor space can be seen by following castings and other parts through the production sequence. Work travels from left to right—from receiving department to casting cleaning—from flatcar to cutting department in the case of steel sheet—from casting cleaning and steel cutting to the layout department—from one machine after another to the assembly floor—from assembly to test, then to flatcars again for shipment.

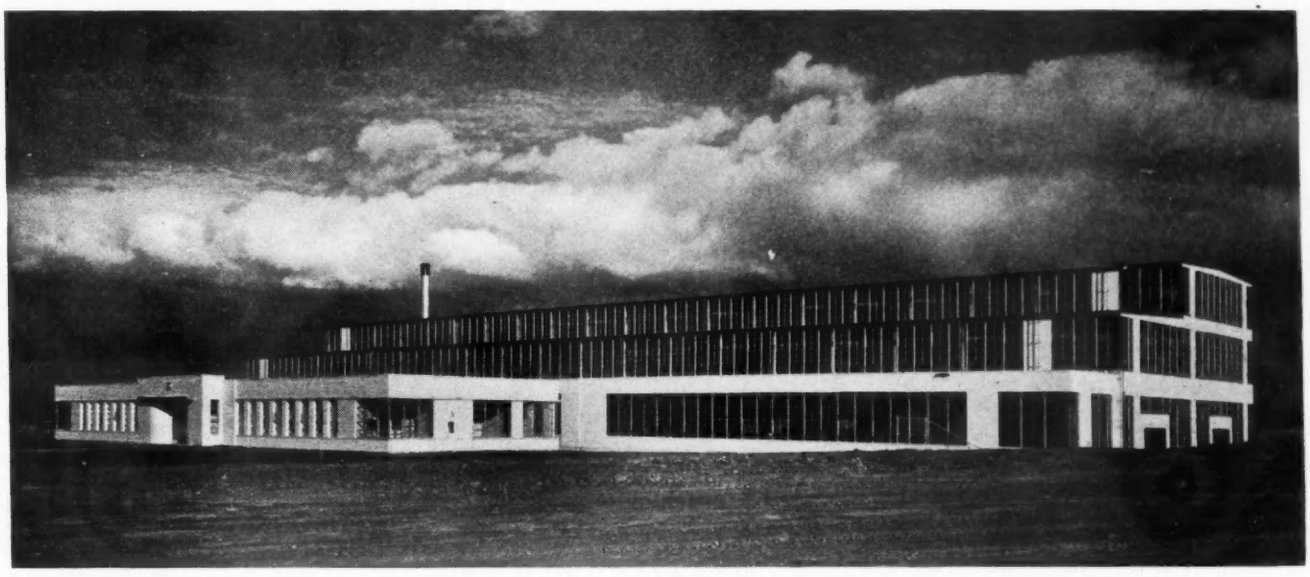
With production flowing from west to east, and one railroad track entering the plant at the west for delivery of large castings and other equipment, assembly and shipping are concentrated at the east end. The floor at this end is four feet lower than in the main production area. This makes it possible to bring railroad cars for outgoing shipments in on the lower level, so that presses can be loaded directly from the main production floor and provides extra head room throughout an area of about 5000 sq. ft. for assembly of presses of exceptional size. Two pits are provided on the lower level so that die cushions, normally located below the floor in actual practice, can be assembled in presses. Heavy concrete floors have been provided throughout the plant with special sections of wood block inset





(Above) Machining a huge casting on a double-side planer in the new HPM plant. The casting on the planer is the bed for an HPM press of 5000-tons pressure capacity. It weighs 142,000 lb.

(Right) Tie-rod being turned in lathe for HPM press. It is 280 in. long, 22 in. in diameter and weighs 28,000 lb.



and MACHINES

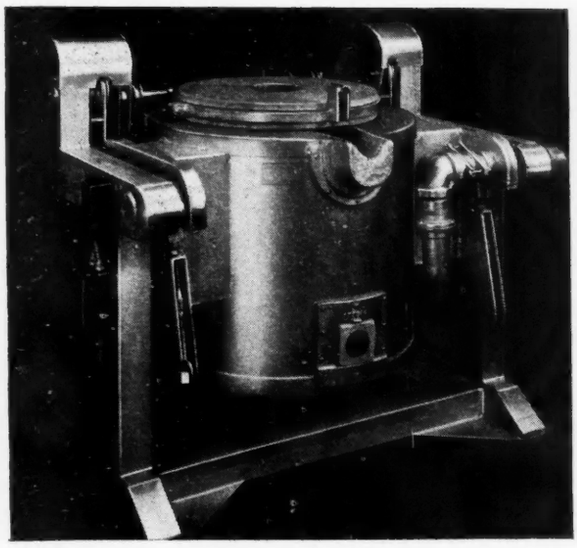
to facilitate the handling of large castings and forgings.

Inasmuch as oil is used as the pressure medium in all HPM presses, provision has been made in the new plant for handling a large volume of oil required for testing. A two-compartment oil storage tank of 5000-gal. capacity is placed underground at the point where the testing is done. Pipe lines with outlets enter beside every building column in the assembly and testing area. Thus, the oil hose leading to a press surge tank is connected to the outlet in much the same simple manner as an electric extension cord plug is connected to an electric wall plug. After the oil has served its purpose in the new press, it is returned by gravity to the second tank. Before the oil is returned to the first tank for reuse, all impurities are removed.

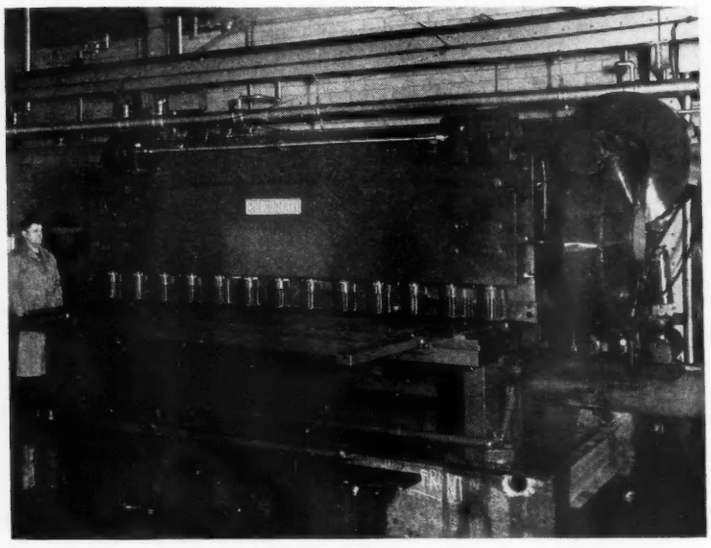
At the west end of the plant rough steel castings, weighing as much as 175,000 lb., are unloaded from railroad "flats" to the layout section with ease and speed. They are lifted onto the beds of huge planers or mills in the case of press cylinder castings, press bed castings and press platen castings, or to long engine lathes should the piece be a press tie-rod or press ram. Large steel castings already machined on a new 10 by 20 ft. double side planer installed in the plant include a 142,000-lb. bed for an HPM 5000-ton "Fastraverse" press, destined for a large aircraft plant. Typical of the work done on lathes is that on large forged steel rods weighing as much as 30,000 lb. and used on HPM presses.

THE FELLOWS GEAR SHAPER CO., Springfield, Vt., now offers the No. 20 M. Red Liner gear checking machine which will handle spur or helical gears up to 18-in. pitch diameter. It operates on the same fundamental principle as the regular Red Liner but is arranged to handle gears on centers which are ad-

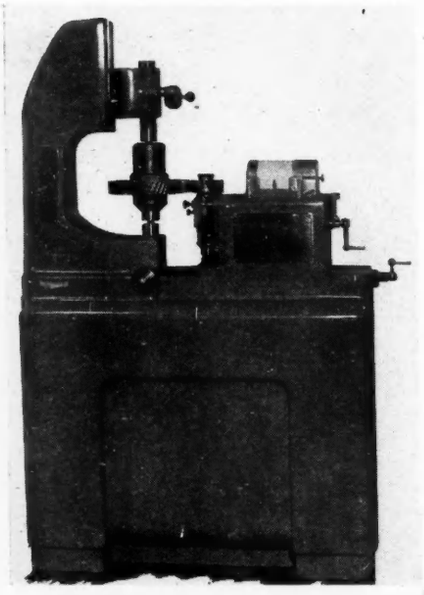
HPM Fastraverse presses being assembled in the company's new plant. Box cars are loaded directly from the working floor, which is at car floor level and serves as a loading platform.



Fisher motorized nose pour crucible furnace.



Cincinnati 1 in. by 12 in. plate shear.

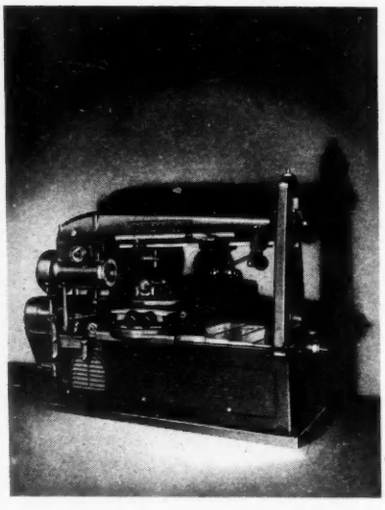


No. 20M Fellows gear checking machine.

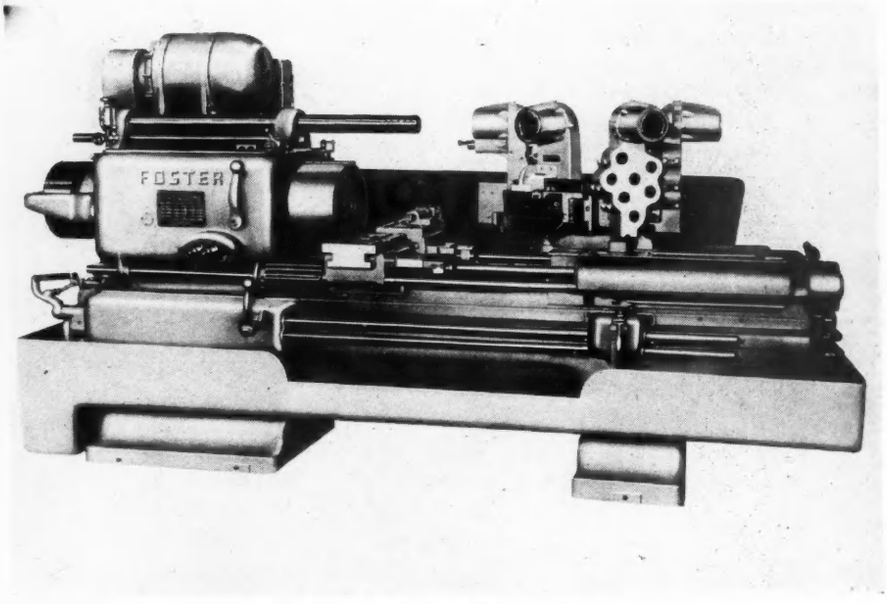
justable. The lower center is adjustable to present the gear in correct relationship to the master gear, and the upper center for handling gears or arbors of different lengths. This equipment also can be arranged for checking internal gears by the use of a suitable holding fixture.

THE Type T hobbing machine built by Barber-Colman Co., Rockford, Ill., is now available with several new attachments and also incorporates a number of improvements. Although the machine as designed originally was intended primarily for hobbing taper splines on shafts, it also has wide application for standard hobbing work, including such parts as spur gears, spiral gears, straight splines, worms, worm wheels, and miscellaneous special hobbed forms. The new attachments and improvements contribute considerably to giving this machine its wider application of usefulness.

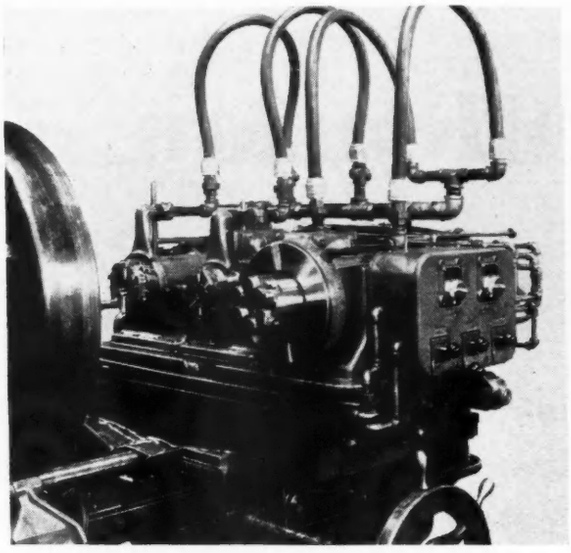
In many respects the machine resembles the regular Barber-Col-



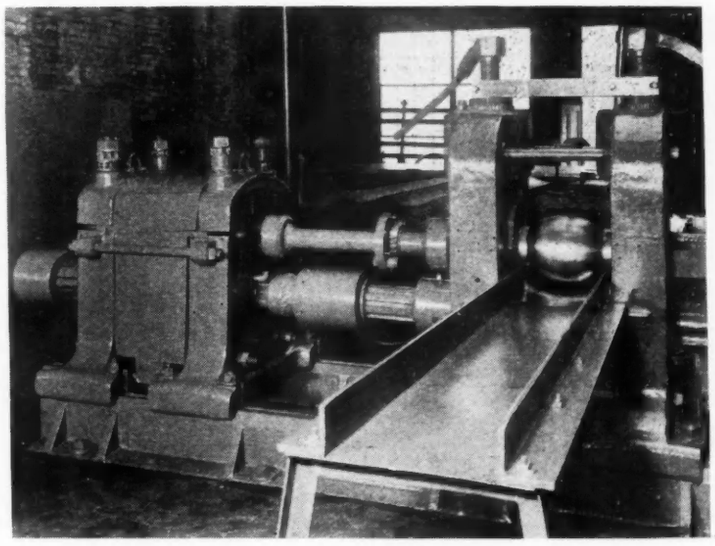
Barber - Colman Type T hobbing machine.



Foster's new No. 1-F Fastermatic.



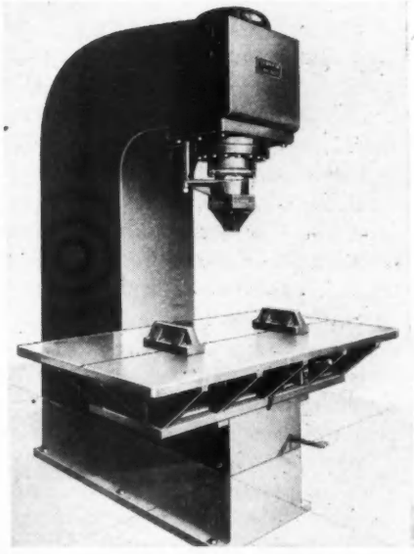
Landis recessing, boring and tapping machine.



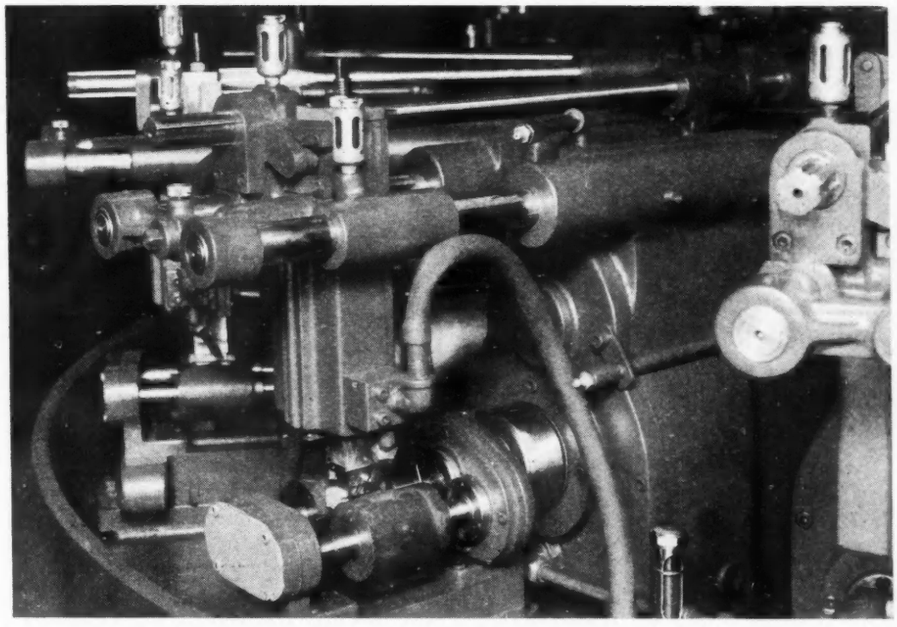
Entering side of roll stand at Tuthill plant.

man Type A hobbing machine, which is used on general purpose or high production work. The main point of difference is in the hob swivel construction of the Type T machine. It provides a means to traverse the hob not only longitudinally, but also laterally at the same time. The result is that the hob is fed in an oblique angle to the work which is necessary in the hobbing of a taper spline on the end of a shaft. In hobbing other types of work, such as spur gears, straight splines and spiral gears, this same oblique hobbing method can be used, or the hob spindle slide can be turned around so that the ways are parallel with the bed ways, and these parts can be hobbed in the conventional manner.

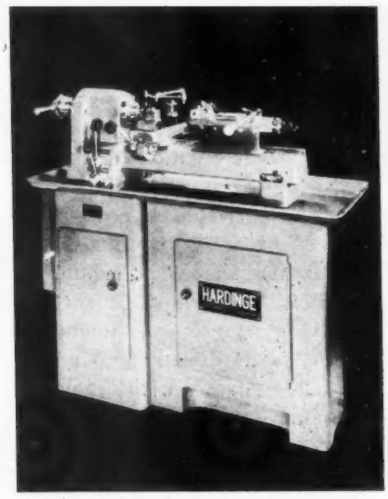
AN ALL-STEEL shear with a capacity for 1-in. mild steel 12 ft. long was built recently by the Cincinnati Shaper Co., Cincinnati, Ohio, for the U. S. Navy Yard, Norfolk, Va. The 10012 series machine is of rolled steel plate construc- (*Turn to page* 655, *please*)



Hannifin 150-ton straightening press.



New 12-spindle Superfinisher by Foster.



Hardinge high-speed second operation machine

Industrial Application of Plastics

are discussed at Lehigh University symposium. Their use in airplane construction received particular attention

A SYMPOSIUM on Industrial Applications of Plastics was held at Lehigh University, Bethlehem, Pa., recently. H. A. Neville, head of the Department of Chemistry and Chemical Engineering of the University, acted as chairman. There were two sessions, one in the afternoon, the other during the evening. The symposium was sponsored by Catalin Corporation, Plaskon Company, *Modern Plastics* magazine, and the Department of Chemistry and Chemical Engineering of Lehigh. Exhibits of cast and molded plastic articles, of fabrics impregnated with synthetic resins and structures built up with synthetic adhesives were staged in a reception hall of Packard Auditorium, in which the symposium was held.

Among the exhibits was a model hydroplane with a hull of plastic material. It carried a small two-cycle engine of the type manufactured for installation in model airplanes. Another exhibit was a section of an airplane wing fabricated from plywood. This plywood is produced with synthetic adhesives which render it waterproof in the sense that it will not delaminate. Similar adhesives or glues were used in joining the the elements of the structure together.

W. R. Thompson, technical director of Catalin Corporation, spoke on the production and use of cast phenolic resins. Catalin, which is a resin of this type, was introduced on the market in 1928. The same as the original phenolic resin, of which finished articles are produced by molding, Catalin is a product of the reaction between phenol and fomaldehyde in the presence of catalysts. While Bakelite and similar plastics are furnished to the molder in the form of powder, Catalin is prepared in the form of a viscous syrup which is poured into molds made of lead or rubber, and it is hardened by heating. Catalin is not mixed with fillers, as are the molded plastics, but is cast in the pure state. It can be given any number of brilliant colors, for which reason it is specially suited for purposes of ornamentation. In the automobile industry it has been used for radiator instruments and for the ball handles of shift levers. The material also comes in the form of rods, sheets and tubes, and it can be machined in the same way as wood or metal.

It appears that the properties of the cast material depend largely on the proportions in which the phenol and formaldehyde are mixed, and graphs were displayed by the speaker which showed how the tensile and compressive strengths and other properties vary with the "molar ratio," that is, with the number of moles of fomaldehyde per mole of phenol. It was shown, moreover, that for Catalin, the same as for steel, the tensile strength is directly proportional to the hardness. For Catalin, a hardness of 35 on the Rockwell B scale corresponds to a tensile strength of 6,000 lb. per sq. in.

Mr. Thompson in his talk called attention to the large expenditure of the plastics industry for research, which he said is materially larger, proportionally, than the expenditure for this purpose of industry generally. Plastics are now being studied by means of photomicrographs, and micrographs with as much as 2000 magnifications were shown.

"The Properties and Uses of Urea-Formaldehyde Resins" was the title of a paper by Dr. M. H. Bigelow, technical director of Plaskon Company, Inc. He said that urea-formaldehyde plastics, which are a variation of the phenol-formaldehyde type, can now be machine-molded. Efforts are being made to expedite the molding process in every way, in order to bring down costs. A considerable proportion of the time of the molding cycle is occupied in rendering the material plastic by heating. The material used for molding is usually in the form of pellets, and as it is a poor heat conductor, it takes considerable time for the heat to penetrate to the center of the pellet. Moreover, the plasticity is not uniform. Some consideration has been given to the possibilities of plasticising by means of short-wave radiation (diathermy). Chemical plasticisers are also being studied.

Urea-formaldehyde products are used in the form of molding compounds, enamels, and glue for waterproof plywood. The enamel is used as an automobile

finish and has the advantage of high elasticity, so that if the finish is scratched by a dog, the scratch will heal automatically. One of the chief applications of urea plastics is in the manufacture of plywood. Skis and beer-barrel staves are made of such plywood.

Urea plastics, the speaker said, are more expensive than the phenolic type, and they must justify their higher cost. They have all the desirable electrical properties of phenol products, and when used as insulators for ignition distributors and similar electrical devices, there is no "tracking" or conducting-charring. The material is inert to all organic compounds. Large quantities of urea compounds are used for buttons, cosmetic containers, and bottle caps.

A paper on Synthetic Resins in Airplane Construction was read by H. N. Haut, chief inspector of Bellanca Aircraft Corporation. He said that synthetic resins are playing an increasingly-important part in aircraft production. One of the reasons is that standards of luxury and eye appeal are constantly being raised in civil aeronautics. Most of the earlier uses of plastics in the aircraft field followed similar uses in the automobile industry. One reason why plastics are likely to be used more extensively in aircraft in the future is that compound curves, which are so necessary in plane construction, can be readily obtained with plastics. Pure synthetic resins cannot well be used for the stuctural parts of airplanes, as they lack the necessary strength. To get a suitable material it is necessary to impregnate other materials with synthetic resin. One experimenter, using long-staple fibers such as hemp as the filler, has been able to get a tensile strength of 100,000 lb. per sq. in., which is remarkable considering the low specific gravity of the material.

Wood used for propellers is impregnated with plastic. This increases its density or specific gravity, and also its strength. It seems that wood and the synthetic resins have a natural affinity for each other. An advantage of this process of manufacturing propellers is that a larger proportion of resin can be used for the wood near the hub, which is subjected to the greatest stress. Three planes of plywood construction have been developed, but so far none of them has gone into production. The use of phenolic-resin adhesives in plywood for aircraft construction is approved by the CAA. In concluding his talk the speaker said that with the rapid growth of both the aircraft and the plastics industry, it was difficult to foretell what the future relation of the two industries would be.

J. McE. Sanderson of the Technical Service Department of the American Cyanamid & Chemical Corporation spoke on Synthetic Resin Coatings, and Dr. R. H. Kienle, research director of Calco Chemical Division of American Cyanamid Company, presented a paper on the Changing Fashions in Polymers.

A moving picture entitled "The Magic of Modern Plastics" was shown by *Modern Plastics* magazine.

Crude-Oil Equipment for Diesel Engines

A CRUDE-OIL-BURNING fuel system has been developed by Caterpillar Tractor Co. and is now available for all 5¾-in. and 5¼-in Caterpillar Diesel engines.

Crude oil passes from settling tanks through a heat exchanger to the fuel transfer pump on the engine. From the pump it goes through a gross filter up to the standard engine fine filter. From there it passes through the fuel injection pumps into the fuel injection valves, and into the cylinders of the engine.

Settling tanks are recommended with the system to lessen the filtering required by the gross filter. When using those tanks, the fuel should be allowed to settle for at least 48 hours, and two or more tanks should be used, each of sufficient capacity to supply fuel for at least 48 hours of operation.

The gross filter removes the major amount of the remaining dirt and abrasives from the oil. It consists of two compartments and has a base which also acts as a manifold for the oil. Each compartment contains two replaceable filter elements, and a pressure gage on the outside of the filter indicates when replacement of the element is called for.

Either one compartment of the filter may be used alone, or both together, the change-over being effected by means of a valve. It is not necessary to shut down the engine for this operation.

The crude-oil-injection equipment differs from the standard Caterpillar fuel system chiefly in being made of corrosion-resistant steel. It is claimed that with this fuel system the performance of the engine is as satisfactory as that of the regular Diesel engines on gas oil, and that the power curves of these latter engines apply to the crude-oil-burning engines.

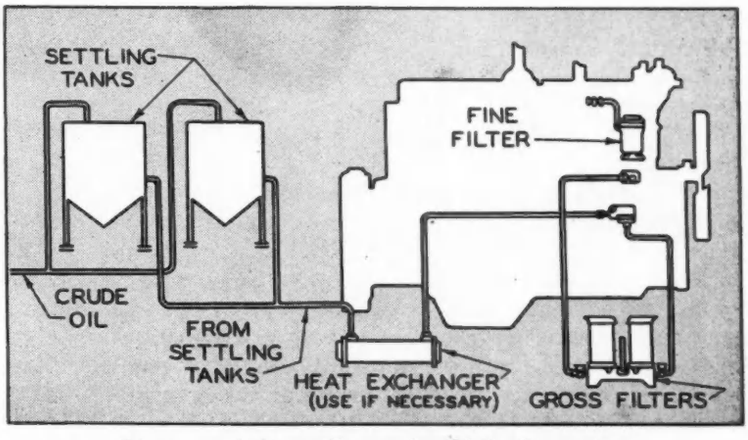


Diagram of Caterpillar-crude-oil-injection system.

Production Lines . . .

Handle Gently

Everyone is familiar with Kleenex—so soothing to tender membranes when you have a cold. Well, it seems that the National Defense Program with its greatly increased tempo of manufacturing within our industry has developed industrial uses for the self same fine paper product, in handling metal parts whose surface perfection needs even more tender care than do irritated membranes. Case in point is a special trip we had through the guarded section of the Cadillac plant where they produce parts for Allison engines that fly the fighting ships of the Army. They make engine bearings, crankshafts, connecting rods, counter weights, etc. Surfaces of these parts are finished to an unusually fine degree of perfection. As we walked through the plant, we noticed that every bench had one or more cartons of the familiar Kleenex. Operators use it for wiping the parts. And finally, after inspection, each fine surface area is wrapped with Kleenex to assure protection in packing and handling.

Shop Manual

Our hat is off to Pontiac for continuing its outstanding job of producing excellent technical literature. We have before us a copy of the 1941 Shop Manual, just off the press. It may well rate as a text book on automobile maintenance and repair. It covers the host of minor and major repairs and adjustments on mechanical parts, on the body, on electrical units. In fact the electrical section is a model of instruction dealing not only with trouble-shooting but also with the use of the latest type of testing equipment available for the purpose. We commend it as a job well done.

Worth Noting

As fender stampings grow bigger and more difficult to draw, what with elongations exceeding the wildest estimates, press shop management would find it a real boon if there were some way of testing new die performance before the start of production. Cost of dies, although vital, is not the only bar. Trouble is that there is little time for try-out. With this in the back of our mind, we were quite stirred by an idea brought to our attention—a proposal to make try-out dies of zinc alloy, dies which could be quickly and inexpensively cast right from the wood pattern or a clay model. This zinc die would be good only for a small number of sample stampings. But the short experimental run would give ample opportunity for spotting the troublesome details, for making corrections in the pattern before the permanent die goes on the Keller machine. In fact corrections could be incorporated in a second zinc die and tried out again for a recheck. Needless to say, the expense is quite negligible since the zinc alloy permits of 100 per cent remelting and salvage. Think it over. If you would like to try it out, let's hear from you.

Case Histories

One of the most ambitious and comprehensive of industrial literature that has come to our attention in recent months is a new handbook service instituted by Barber-Colman. So new in fact that the first mailing of the book to a limited list is just being made. The handbook, "Hobbing Data" is of catalog size, of loose leaf form, comes in a handsome durable cover. The initial mailing contains pages describing the latest B-C machines, supplemented with a fairly large selection of specific case studies. At regular intervals, new case studies will be available for filing in the binder. Eventually this book should constitute an up-to-date source of data on hobbing practice and hobbing economics. The mailing is limited but any friend of this department can get it, if you apply early.

Vetoes Dermatitis

Troublesome problem in certain industrial processes is dermatitis—skin eruptions and complications arising from intimate contact with chemicals, oils, etc. This problem has been investigated by many authorities, latest report on the subject being a booklet entitled "Industrial Dermatitis," issued by The Milburn Co. A comprehensive scientific study of the subject, its content is well worth special attention. Most instructive is the conclusion, enumerating the steps that may be taken to prevent dermatitis and its industrial hazards. We shall be glad to get you a copy.

Wet Grinding

September issue of *The Gardner Grinder*, a publication of the Gardner Machine Co., has an interesting discussion of the best types of coolant to be employed in wet disk grinding operations. They touch on soluble oils, paste type materials, and mineral oils, and promise to give you complete recommendations. Don't overlook this opportunity to get posted on the most advanced practice in this field.—J. G.

NEWS OF THE INDUSTRY

Ford To Build "Pygmy" Trucks For U. S. Army

Receives $1,387,500 Government Contract For 1500 Small But Powerful Vehicles To Be Delivered Early In January

Manufacture of a fleet of "pygmy" trucks which bear the formidable U. S. Army designation of "command reconnaissance 4-4's" is now under way in several automotive plants. The Ford Motor Co. expects to begin manufacture of its version of these tiny but powerful vehicles early in January, having received a government order for 1500 of them valued at $1,387,500, or $975 apiece.

American Bantam Car Co., of Butler, Pa., has delivered 70 of these combat cars on an initial order for 1500. Continental Motors Corp. has a $294,662 order for 2000 four-cylinder, 40-hp. engines which it is making at its Muskegon plant and which will be installed in the Bantam trucks.

The "pygmy" vehicles, which weigh approximately a ton, will be used to do the job performed by motorcycles and sidecars in the Nazi Panzer divisions. If the first ones prove successful, the Army plans a fleet of 30,000 of these cars. Their four-wheel drive provides them with plenty of traction for the most rugged terrain and they are capable of traveling 60 m. p. h. Their light weight will make it possible to transport two or three of them in a transport or bombing plane, providing a very mobile unit.

The trucks are designed to carry three men and a machine gun but they can be used in hauling light field pieces or quick transport of troops. The Ford version utilizes an adaptation of the Ford tractor engine, 42-hp. and with four cylinders. A feature of the four-wheel drive is the fact that the front axle can be used either as a driving axle or an idling axle. There is an auxiliary transmission in addition to the regular gear box, whch provides six speeds forward and two in reverse.

The Ford truck has an 81-in. wheelbase and stands 38 in. high at the cowl. It is equipped with 5.50 by 16 tires with heavy mud and snow tread. There are blackout lamps front and rear in addition to the regular lighting equipment. A brush guard protects the front of the car and there is a windshield which folds flat over the hood. There also is a folding top or canopy.

These vehicles have demonstrated remarkable performance in tests at Camp Holabird, Md. They can carry one-quarter ton of cargo over very difficult terrain and are capable of climbing a 76 per cent grade.

Karl Probst, Detroit consulting engineer, designed the Bantam version of the midget truck and is now serving temporarily as Bantam's chief engineer.

Wilbert J. Austin

Wilbert J. Austin, president of the Austin Co., national organization of engineers and builders, died in Chicago, Dec. 4, as the result of an airliner crash.

Timken Expands to Meet Defense Requirements

A $3,000,000 expansion program, designed to meet defense requirements, is under way in the four plants of The Timken Roller Bearing Co. at Canton, Gambrinus, Columbus and Mt. Vernon, Ohio. The entire expansion program involves an immediate expenditure of $2,217,400 with projected additional expenditures which will bring the total to the $3,000,000 mark.

Tin Research Institute

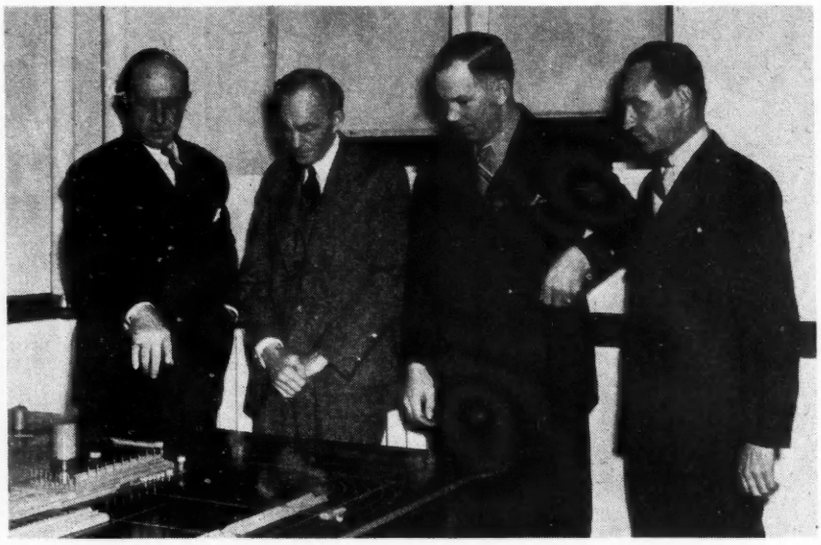
In the October, 1940, issue of *Tin and Its Uses*, the International Tin Research and Development Council announces that its organization at Greenfield, Middlesex, England, will now be known as the Tin Research Institute, direction and finance remaining unchanged.

Automotive Committee for Air Defense Incorporates

Articles of incorporation for the Automotive Committee for Air Defense have been filed at the Michigan Secretary of State's office to give the organization status as a non-profit corporation. The committee was created by the automotive industries on Oct. 25, at the request of Defense Commissioner William S. Knudsen, to make automotive resources available for production of parts and sub-assemblies for the aircraft manufacturing industry.

Ford "Pygmy"

First of the new Ford "Command-reconnaissance 4-4's" designed to replace motorcycles and side cars in the army's new mechanized division. (See story, this page.)



Ford Naval School

More than 300 Navy men will go to Dearborn, Mich., in January for a three-months' course in machine, metal, woodwork and other trades to be given at the Ford Rouge plant. Inspecting a scale model of the plant are (l. to r.): Rear Admiral John Downes, Henry Ford, Commander A. H. Richards and Edsel Ford. A barracks to house the men is being donated by Henry Ford to the Navy Department.

Aircraft Industry Expansion Summarized by Col. Jouett

Plant Additions Total $83,356,580 with $232,188,472 More "On Order"; Employment to Reach 382,000 by June

American manufacturers of aeronautical equipment have spent $83,356,580 on plant expansion for national defense, and have let contracts for an additional $232,188,472 worth of facilities which will be in operation by next June. These figures were reported by Col. John H. Jouett, president of the Aeronautical Chamber of Commerce of America, at its annual meeting in New York on Dec. 5. Mr. Jouett added that the industry has already expanded payrolls from 60,000 shop employes last January to 164,920 at present and is expected to have 382,000 shop employes when the current expansion programs are completed next June. This does not include sub-contractors.

"Last January the industry's productive floor space totaled 11,983,896 sq. ft.," Mr. Jouett continued. "As of Dec. 31 this year we will have 22,530,988 sq. ft., and an additional 22,635,190 sq. ft. under construction.

"Our survey shows a backlog as of Nov. 1, of $2,831,665,159 as compared to $675,432,475 on Dec. 31, 1939. It is estimated that the deliveries for 1940 will total approximately $625,000,000 as compared to $225,000,000 last year.

"Taking the various branches of the industry individually, airplane manufacturers as of Jan. 1, 1940, had 7,410,133 productive sq. ft. compared to 12,664,600 sq. ft. at present. They also have under construction an additional 15,965,951 sq. ft. Engine builders as of Jan. 1, 1940, had 2,210,730 sq. ft. compared to present productive space of 5,272,479 sq. ft. Upon completion of present program, they will have a total of 9,700,958 sq. ft. Manufacturers of propellers as of Jan. 1, 1940, had 393,240 productive sq. ft. Today they have 845,800 sq. ft., and an additional 108,000 sq. ft. under construction. Principal accessories manufacturers as of Jan. 1, 1940, had productive space totaling 1,969,793 sq. ft., while today they have 3,748,109 sq. ft. with an additional 2,132,760 sq. ft. under construction."

Goodyear Begins New Plant for "Chemigum"

Construction of a new plant for the manufacture of its synthetic rubber, Chemigum, has been announced by The Goodyear Tire & Rubber Co. Production will begin as soon as equipment can be installed, probably within six months.

The new plant, a combination one-and-two-story structure, will be located in Akron close to the company's factories, and will step up output of the present pilot plant about 300 per cent.

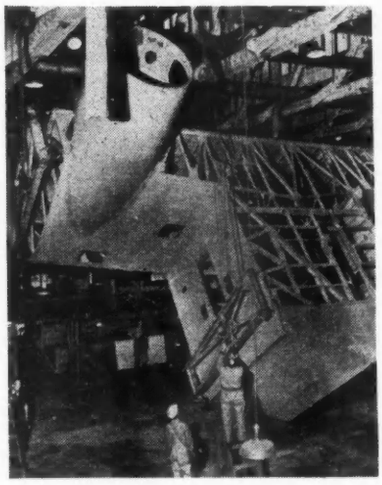
Packard Electric Holds Open House

The Packard Electric Division of General Motors, Warren, Ohio, celebrated its fiftieth anniversary on Nov. 22 by introducing its new plant to 8690 visitors in an open house. The new plant, incorporating latest features in design for the comfort, convenience and welfare of workers as well as manufacturing efficiency, gives ample room for expansion.

New Passenger Car Registrations and Estimated Dollar Volume by Retail Price Classes*

PRICE CLASS	NEW REGISTRATIONS								ESTIMATED DOLLAR VOLUME							
	OCTOBER				TEN MONTHS				OCTOBER				TEN MONTHS			
	Units		Per Cent of Total		Units		Per Cent of Total		Dollar Volume		Per Cent of Total		Dollar Volume		Per Cent of Total	
	1940	1939	1940	1939	1940	1939	1940	1939	1940	1939	1940	1939	1940	1939	1940	1939
Chevrolet, Ford and Plymouth	154,967	97,312	53.42	45.79	1,499,065	1,184,368	54.00	54.46	$126,058,000	$74,400,000	46.52	39.56	$1,154,058,000	$870,300,000	47.61	47.06
Others under $1,000	40,935	82,098	14.11	38.63	843,442	777,799	30.38	35.77	37,547,000	74,400,000	13.85	39.56	763,347,000	711,000,000	31.49	38.45
$1,001 to $1,500	90,073	30,702	31.05	14.45	412,232	180,850	14.85	8.32	100,451,000	34,700,000	37.06	18.46	465,051,000	209,800,000	19.19	11.35
$1,501 to $2,000	3,695	1,636	1.27	.77	14,741	20,657	.53	.95	5,866,000	2,800,000	2.16	1.49	25,061,000	32,000,000	1.03	1.73
$2,001 to $3,000	433	766	.15	.36	6,649	10,267	.24	.47	1,071,000	1,700,000	.40	.90	16,089,000	23,300,000	.66	1.26
$3,001 and Over	6	27	.....	.....	77	645	.....	.03	30,000	125,000	.01	.03	370,000	2,925,000	.02	.15
Total	290,109	212,541	100.00	100.00	2,776,206	2,174,586	100.00	100.00	$271,023,000	$188,125,000	100.00	100.00	$2,423,976,000	$1,849,325,000	100.00	100.00
Miscellaneous	386	45	.....	.....	3,380	676	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total	290,495	212,586	.....	.....	2,779,586	2,175,262	.....	.....	$271,023,000	$188,125,000	.....	.....	$2,423,976,000	$1,849,325,000	.....	.....

* All calculations are based on delivered price at factory of the five-passenger, four-door sedan, in conjunction with actual new registrations of each model. The total dollar volumes are then consolidated by price classes.



Giant Sub-Assembly

This huge center section slice will soon form a part of one of six new Boeing super-clippers being built to augment the Pan American Airways fleet. These new A-314s, having a gross weight of 84,000 lb., are similar to the present 314s but will be equipped with more powerful 1600 hp. Wright Cyclones and carry 5400 gal. of gasoline.

Frank M. Raymond

Frank M. Raymond, vice-president of the Associated Spring Corp., and its affiliated company, Raymond Mfg. Co., Corry, Pa., died on Nov. 7.

ASTE Picks Toronto For Summer Meeting

For the first time in its history, the American Society of Tool Engineers will go outside of the United States for a convention meeting. Toronto, Canada, has been selected as the site for the 1941 semi-annual meeting, to be held in October. The annual meeting, the week of March 25, is scheduled for Detroit in conjunction with the 1941 Machine & Tool Progress Exhibition.

Speakers Stress National Defense at NAM Congress

Heralded as industry's biggest annual get-together, the forty-fifth Congress of the National Association of Manufacturers took place at the Waldorf-Astoria Hotel, New York, Dec. 11 to 13. With much of the emphasis turned toward National Defense, delegates heard Henning W. Prentis, president of NAM and of Armstrong Corp., talk on "Total Preparedness for America's Future"; William S. Knudsen, of the Advisory Commission of the National Defense Council, on "Industry Meets the Challenge of Defense," and J. Edgar Hoover, director of the Federal Bureau of Investigation, on "Sabotage and Fifth Column Activities."

Other headline speakers included J. Howard Pew, president, Sun Oil Co.; Phillip D. Reed, chairman, General Electric Co.; Charles F. Kettering, Dr. Will Durant, Gen. Robert E. Wood, Gen. Hugh Johnson, Lowell Thomas and many others.

MEMA October Index Shows Sharp Upturn

Shipments of original equipment, accessories and service parts all advanced in October over the previous month, according to the Motor & Equipment Manufacturers Association, while service parts declined but a single point. The MEMA's grand index for all branches of the industry rose to 190 per cent of the January, 1925, base as compared with 178 per cent for September, and 146 per cent for October, 1939.

Frank B. Hamerly

Frank B. Hamerly of Aurora, Ill., vice-president of the Independent Pneumatic Tool Co., Chicago, died Nov. 27, of a heart attack while inspecting the company's plant at Los Angeles, Cal. He was 53 years old.

Honors on Wheels

The increased use of motor vehicles in the Army has caused a change to be made in the Army regulations that prescribe honors to be rendered when the national anthem is played.

The present regulations, now changed, require that all vehicles in motion will be brought to a halt when the national anthem is played, and occupants of the vehicles, except drivers, will dismount and salute, while the drivers will sit at "Attention."

The change prescribes that vehicles in motion will be brought to a halt whenever or wherever the national anthem is played, or "To the Color" (standard) sounds, and that persons riding in passenger cars or motorcycles will dismount and salute. Occupants of other types of military vehicles (other than passenger cars and motorcycles) will remain seated in the vehicles at "Attention" and the person in charge of the vehicle will dismount and render the hand salute, except tank commanders, who will salute from the vehicle.

Passenger Car Trailer Production Drops 35%

Production of passenger car trailers in 1939 reported to the Bureau of the Census totaled 16,052 units, valued at $7,890,869, compared with 24,900, valued at $10,503,627 in 1937. In addition the respective values of those not reported by number were $54,335 and $51,260.

Of the 1939 total, 11,782 units were identified as coach trailers, 253 as commercial display trailers, and 4017 as other types. Comparable breakdown of the 1937 total showed 18,130 coach-type units, 868 display units and 5902 miscellaneous types.

CALENDAR

Conventions and Meetings

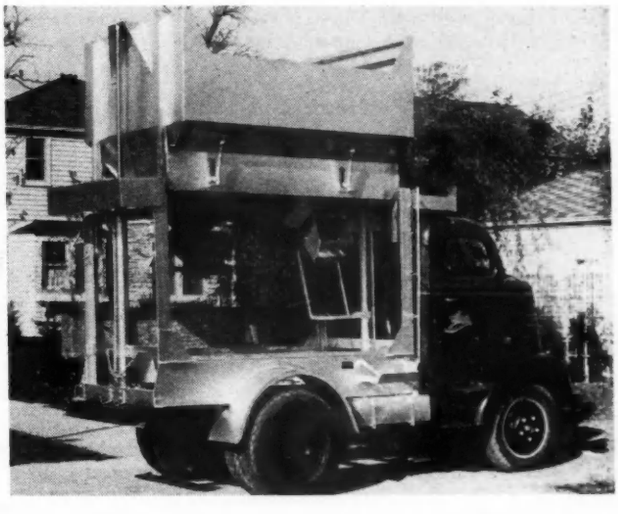
SAE Annual Meeting, Detroit, Jan. 6-10, 1941
American Engineering Council, Washington .....Jan. 11-13, 1941
National Automobile Dealers Association, Convention, Pittsburgh, Pa., Jan. 20-23, 1941
Automotive Tool & Die Manufacturers Association, Detroit .....Jan. 21, 1941
American Road Builders Association, New York .....Jan. 27-31, 1941
Chamber of Commerce of the U.S.A., Washington .....Apr. 29—May 1,1941

Shows

National Motor Boat Show, New York, Jan. 10-18, 1941
Machine & Tool Progress Exhibition, Detroit .....Mar. 24-29, 1941

Hi-Lift

This "Hi-Lift" hopper body, mounted on a Dodge truck, is designed for faster and easier unloading. Made by the Heil Co., Milwaukee, and known as Model H2, the unit's capacity is 125 cu. ft.



Business in Brief

***Written by the Guaranty Trust Co., New York, Exclusively for* AUTOMOTIVE INDUSTRIES**

Phenomenal expansion of business activity was registered in the past few weeks. The New York *Times* seasonally adjusted index for the week ended Nov. 23 rose to the highest level ever reached, 117 per cent of the estimated normal—7.1 points above the figure for the preceding week and 2.2 points above the previous peak in June, 1929. The unadjusted index of *The Journal of Commerce* for the same period, reflecting observance of Thanksgiving day, declined to 111.5 per cent of the 1927-29 average, as compared with 114.3 two weeks earlier and 103.2 a year ago.

Retail trade was further enlivened during week ended Nov. 30, according to Dun & Bradstreet, with estimated regional averages 8 to 10 per cent higher than a year ago. Department store sales during the preceding week were 9 per cent above the comparable 1939 total, according to the Federal Reserve tabulation.

Total production of electricity by the power and light industry during the week ended Nov. 23 was moderately below the all-time peak recorded for the week before; but the average daily output advanced against the seasonal tendency and the aggregate was 8.6 per cent greater than a year ago.

The movement of railway freight in the same period showed much less than the usual seasonal decline. The number of cars loaded, 733,488, was 1.6 per cent below the figure for the preceding week but exceeded by 9 per cent the comparable loadings last year.

Business failures during the week ended Nov. 28 numbered 258, as compared with 256 in the week before and 264 a year ago, according to the Dun & Bradstreet compilation.

Crude oil production in the final week of November dropped sharply to an average of 3,335,050 barrels daily and was 234,950 barrels less than the required output as computed by the Bureau of Mines.

Average daily output of bituminous coal during the week ended Nov. 23 was 1,727,000 tons, as against 1,800,000 tons in the preceding week and 1,755,000 tons a year ago.

Engineering construction contracts awarded during the week ended Nov. 28 registered further expansion, according to *Engineering News-Record*. This was the thirteenth consecutive week in which awards exceeded 1939 levels, and the cumulative total for the year to date is 28 per cent above that a year ago.

Cotton mill activity rose contraseasonally in the week ended Nov. 23. The New York *Times* adjusted index advanced to 161.2, as against 139.7 for the preceding week and 146.4 a year ago.

Professor Fisher's index of wholesale commodity prices advanced last week to 84.7 per cent of the 1926 average, after standing for a fortnight at 84.5.

Reserves of the member banks of the Federal Reserve system increased $165,000,000 in the week ended Nov. 27, with excess reserves advancing to an estimated total of $6,930,000,000. Business loans of the reporting members rose $3,000,000 and stood $530,000,000 above the total a year ago.

Vocational Training Program In High Gear

Over 10,000 Michigan Workers Prepared For Defense Jobs Within Past Three Months; Mid-1941 Goal Set At 25,000

Ten thousand four hundred Michigan workers have received vocational training for places in the national defense program in the last three months and 15,000 more are expected to complete these eight to 10-week courses by next June 30. The government has appropriated $26,000,000 throughout the nation for this type of training.

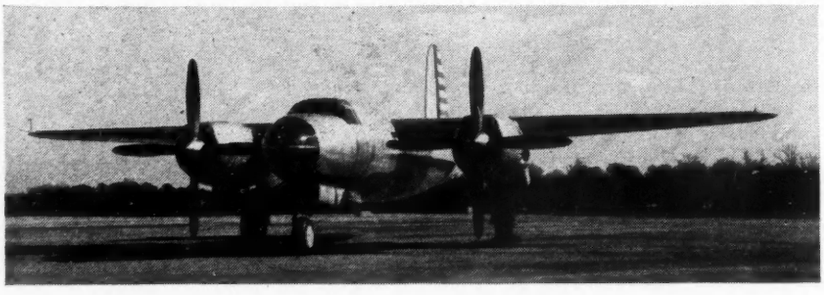
The third set of Michigan classes began Dec. 2 under the guidance of the State Board of Control for Vocational Education, directed by George H. Fern. The WPA, the NYA, the Michigan State Employment Service, industrial concerns and unions are cooperating in guiding skilled workers into factories working on defense contracts. Pre-employment as well as "refresher" courses for workers who have been out of jobs for some time are included in the programs offered. These courses are designed to acquaint the workers with modern industrial methods and to qualify them for specific payroll jobs.

Estimates of the number of workers required on defense projects in Michigan during the next year range from 40,000 to 75,000. The National Youth Administration is building seven "work experience centers" throughout the state at which young men will be trained in sheet metal, machine shop, forge and similar capacities. These centers will have dormitories, mess halls, kitchens and complete shop training facilities. They will accommodate 80 youths each.

Industrial employment in the Detroit area totaled 418,400 workers on Nov. 15, the highest total since November, 1937. There were 149,724 applications for jobs on file with the Michigan State Unemployment Service Dec. 1, 33 per cent less than a year ago. Unemployment insurance benefit payments have been $8,022,509, or 23 per cent less than in 1939. The balance in the Michigan Unemployment Compensation Fund was $72,215,274 on Nov. 23, which was $23,739,816 greater than a year ago. However, $2,000,000 sought by Chrysler Corp. workers as an outgrowth of last year's 54-day strike still remains in litigation in the courts.

Employment in the automobile industry in Michigan totaled 309,287 workers in October, which was 13 per cent greater than the same month of 1939. Weekly payrolls of $12,473,046 during October were 30 per cent higher than a year ago. The average weekly earnings in the automobile industry in October were $40.45, compared to $35.67 in October, 1939. Time and a half for overtime pay in some plants, which were working longer shifts and Saturdays, helped account for the high average.

James F. Dewey, federal labor conciliator, hurried from Birmingham,



Fastest Bomber?

Powered by two 18-cylinder, 1850-hp. Pratt and Whitney engines, this latest Martin B-26 is ready for final tests which may prove it to be the world's fastest bomber. Carrying a crew of five, it is of semi-high-wing design with tricycle landing gear.

40 YEARS AGO

The Central Passenger Association has decided that automobiles are not baggage. Some of the theatrical companies thought they were, and insisted on having them checked. The passenger association saw no rooms for trunks in the future if "autos" were to be run in, and so declared them contraband at once as baggage. Automobile owners claim the same rights as bicycle riders, whereupon the railroad authorities say they might as well argue that horses and equipages ought to have a brass tag put on them and be carried free. From the *Horseless Age*, December, 1900.

Ala., to Detroit Dec. 1 to settle a dispute that closed briefly the plants of the Briggs Mfg. Co. and the Plymouth Division of Chrysler Corp. The day shift of 5000 at Briggs had to leave

(*Turn to page* 654, *please*)

SAE Annual Meeting —Detroit, Jan. 6-10

Twenty-one technical sessions including discussions of National Defense problems by outstanding speakers, an unusual display of Army air, ordnance and quartermaster equipment, and the S.A.E. Annual Dinner will highlight the five-day annual meeting of the Society of Automotive Engineers which opens at the Book-Cadillac Hotel, Detroit, on Jan. 6.

A tentative program outlines the follow subjects and speakers:

Monday, Jan. 6: "Characteristics of Exhaust Gas Analyzers"—J. L. Dilworth, Pennsylvania State College; "The M.I.T. Wright Brothers Wind Tunnel and Its Operating Equipment"—Prof. John R. Markham, Massachusetts Institute of Technology; "Effect of Opposite Rotating Propellers on Static Longitudinal Stability"—C. W. Scott, N. B. Moore and L. B. Rumph, St. Louis Airplane Div., Curtiss-Wright Corp.; "Significant Structural Developments in Motorcoach Design"—M. C. Horine, Mack Mfg. Corp.; "Outline of a General Approach to the Flutter Problem"—S. J. Loring, Vought-Sikorsky Aircraft; "Visualized Airflow"—Roger W. Griswold II, aerodynamic consultant; "Made in America Substitutes"—H. W. Gillett, Batelle Institute.

Tuesday, Jan. 7: "Toll Roads and Truck and Bus Transportation"—Charles M. Noble, Pennsylvania Turnpike Commission; "Compounding Facts and Fallacies"—F. L. Prescott, U. S. Army Air Corps; "Aircraft Cylinder Finishes"—Myron A. Coler, Paragon Paint and Varnish Corp.; "Brake Equalization Problems"—J. W. Votypka, Fruehauf Trailer Co., and A. Vance Howe, Bendix Westinghouse Auto Brake Co.; "Modern Aircraft Engine Testing"—W. D. Gove, Pratt & Whitney Aircraft; "Some Factors Influencing the Performance of Diaphragm Indicators of Explosion Pressures"—F. R. Caldwell and E. F. Flock, National Bureau of Standards; "Motor Transportation in the National Defense Program"—Major General E. B. Gregory, Quartermaster General; "The S.A.E.'s National Defense Program"—B. B. Bachman, chairman, S.A.E. National Defense Committee.

Wednesday, Jan. 8: "The Development and the Employment of the Armored Force"—Major General C. L. Scott, commanding General Armored Force; and talks on "The Aviation Program in National Defense"—Major General G. H. Brett, chief of Air Corps, and Rear Admiral J. H. Towers, chief of Bureau of Aeronautics.

The Annual Dinner will be held Wednesday evening.

Thursday, Jan. 9: "Rubber"—L. B. Sebrell and R. P. Dinsmore, Goodyear Tire & Rubber Co.; "Metals"—Zay Jeffries, General Electric Co.; "The Status of the Automotive Diesel"—Prof. E. H. Fezandie, Stevens Institute of Technology; "Diesel Engines for the Navy"—Lieut. Commander M. M. Dana, U. S. Navy; "Special Problems in Mass Production of Automotive Defense Equipment"—Wm. S. Knudsen, National Defense Advisory Commission.

Two symposiums will also be held on Thursday. "Wide-Base Rims" will be discussed by E. A. Roberts, Firestone Tire & Rubber Co.; R. D. Evans, Goodyear Tire & Rubber Co.; S. M. Cadwell, U. S. Rubber Co., and a representative of B. F. Goodrich Co. "Instrumentation" will be discussed by Kenneth Brown, Caterpillar Tractor Co.; Harry F. Bryan, International Harvester Co.; L. E. Hebl, Shell Oil Co.; H. V. Nutt and W. F. Joachim, U. S. Naval Engineering Experiment Station; Sidney Oldberg, Chrysler Corp.; Prof. P. H. Schweitzer, Pennsylvania State College, and Prof. G. C. Wilson, University of Wisconsin.

Friday, Jan. 10: "A 13-Year Improvement in Mixture Ratios"—W. G. Lovell, J. M. Campbell, B. A. D'Alleva and P. K. Winter, General Motors Research; "The 1940 CFR Road Tests"—J. M. Campbell, General Motors Research; "Color Research and Its Relation to One Phase of the Automotive Industry"—W. H. Beck, Sherwood Brothers; "Engine Design Versus Engine Lubrication"—R. J. S. Pigott, Gulf Research & Development Co.; "Lubrication of Severe Duty Diesel Engines"—J. G. McNab, W. C. Winning, B. G. Baldwin and F. L. Miller, Standard Oil Development Co. "Steel Metallurgy" will be discussed by A. L. Boegehold, General Motors Research Labs.; F. E. McCleary, Chrysler Corp.; O. V. Greene, Carpenter Steel Co.; M. Asimow, W. F. Craig and M. A. Grossmann, Carnegie-Illinois Steel Corp.

Passenger Car and Truck Production

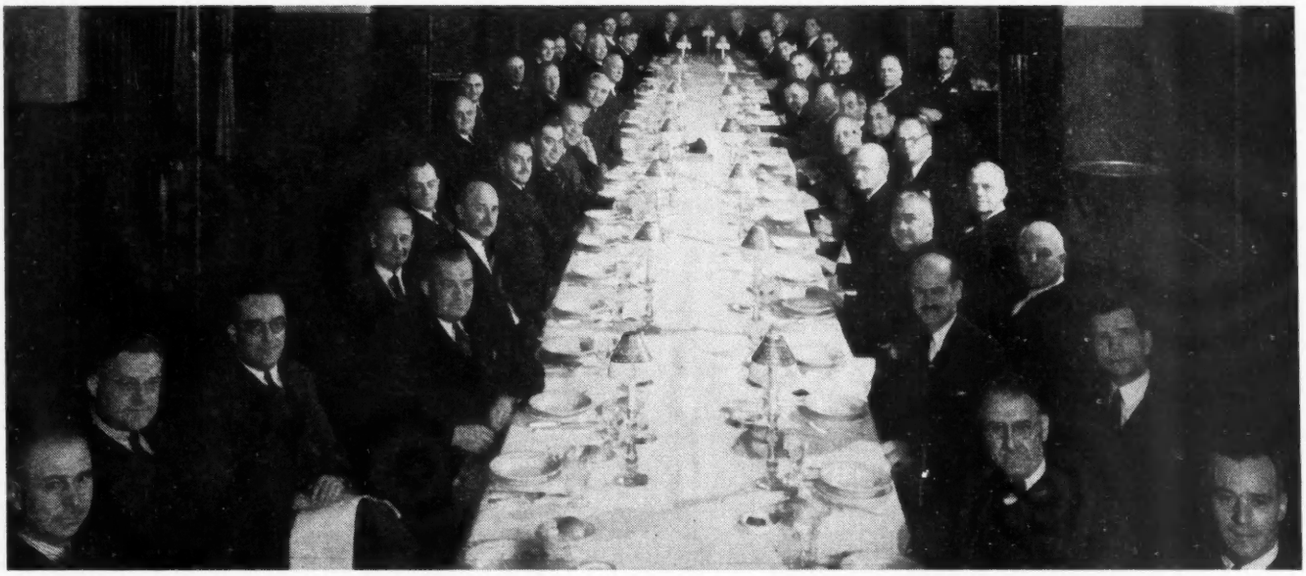
(U. S. and Canada)

	October 1940	September 1940	October 1939	TEN MONTHS 1940	TEN MONTHS 1939	TEN MONTHS Per Cent Change
Passenger Cars—U. S. and Canada						
Domestic Market—U. S.	411,016	220,696	239,150	2,801,704	2,071,722	+35.1
Foreign Market—U. S.	10,198	3,774	12,669	87,002	136,018	−36.0
Canada	7,056	3,410	7,791	87,659	87,433	+ 0.4
Total	428,270	227,880	259,610	2,976,365	2,295,173	+29.8
Trucks—U. S. and Canada						
Domestic Market—U. S.	59,639	33,487	50,903	513,931	443,361	+15.9
Foreign Market—U. S.	12,370	5,151	10,670	95,798	122,264	−21.7
Canada	14,095	12,065	3,506	83,340	34,261	+158.0
Total	86,104	56,703	65,079	698,069	599,886	+16.5
Total—Domestic Market—U. S.	470,655	260,183	290,053	3,315,635	2,515,083	+31.7
Total—Foreign Market—U. S.	22,568	8,925	23,339	182,800	258,282	−29.3
Total—Canada	21,151	15,475	11,297	175,999	121,694	+45.0
Total—Cars and Trucks—U. S. and Canada	514,374	284,583	324,689	3,674,434	2,895,059	+27.0

New Passenger Car Registrations*

	October 1940	September 1940	October 1939	TEN MONTHS 1940	TEN MONTHS 1939	Per Cent Change, 10 Months 1940 over 1939	Per Cent of Total Ten Months 1940	Per Cent of Total Ten Months 1939
Chevrolet	71,689	30,805	25,246	692,522	474,002	+ 46.0	24.92	21.79
Ford	41,761	13,771	34,500	441,523	390,206	+ 13.0	15.88	17.94
Plymouth	41,517	19,442	37,566	365,020	320,160	+ 14.0	13.13	14.72
Buick	32,283	20,186	23,522	238,804	167,547	+ 42.0	8.59	7.70
Pontiac	22,576	11,805	14,180	186,855	123,587	+ 51.0	6.72	5.68
Dodge	10,273	7,144	13,773	163,883	163,239	+ 0.3	5.90	7.50
Oldsmobile	18,627	9,083	13,189	159,629	112,835	+ 41.6	5.74	5.19
Studebaker	10,113	6,840	8,576	85,477	67,497	+ 26.7	3.08	3.10
Chrysler	6,496	3,069	6,183	78,994	58,078	+ 36.1	2.84	2.67
Hudson	8,044	7,156	8,240	67,694	46,513	+ 45.5	2.44	2.14
Mercury	4,759	2,821	4,321	65,577	51,755	+ 26.6	2.36	2.38
Packard	7,046	5,342	8,286	62,303	47,178	+ 32.0	2.24	2.17
De Soto	4,820	3,392	4,727	58,844	47,018	+ 25.0	2.12	2.16
Nash	2,534	2,182	4,283	42,262	44,429	− 4.6	1.52	2.04
Willys	1,418	1,386	1,864	17,990	10,810	+ 66.5	.65	.50
Lincoln	1,859	1,040	1,271	17,400	15,914	+ 9.2	.63	.73
La Salle	381	1,044	1,541	16,314	16,995	− 4.0	.59	.78
Cadillac	3,590	711	960	12,342	10,344	+ 19.3	.44	.48
Graham	201	206	142	1,526	3,552	− 57.0	.05	.16
Bantam	44	55		745			.03	
Crosley	48	30		369			.01	
Hupmobile	40	19	20	133	887	− 85.0		.04
Miscellaneous	386	471	197	3,380	2,716	+ 24.5	.12	.13
Total	290,495	148,000	212,586	2,779,586	2,175,262	+ 28.0	100.00	100.00
Chrysler Corp.	63,096	33,047	62,249	666,741	588,495	+ 13.3	23.99	27.05
Ford Motor Co.	48,379	17,632	40,092	524,500	457,875	+ 14.5	18.87	21.05
General Motors Corp.	149,146	73,634	78,637	1,306,466	905,310	+ 44.2	47.00	41.62
All Others	29,874	23,687	31,609	281,879	223,582	+ 26.0	10.14	10.28

* October 1940 and 1939 can be taken as one month of 1941 Model Year compared with 1940 Model Year.



Editors Meet Uncle Sam's Officials

Getting the Government viewpoint at first hand, editors of the country's leading business magazines periodically visit Washington en masse and meet with Uncle Sam's Men-of-the-Moment who are directing national affairs of outstanding importance. Jesse Jones, Secretary of Commerce, and Director of the Reconstruction Finance Corp., was the focal point of the gathering depicted. It was one of several similar meetings with high government officials held during a recent two-day session of the National Conference of Business Paper Editors.

Largest Independent Steel Maker to Up Capacity 8%

Benefit for Consumers Generally Seen in Lessened Pressure on Supply of Raw Material for Naval Work

In spite of repeated assurances by some of the leading steel producers that their industry's capacity was sufficient to take care of national defense needs as well as those of peace-time industry, announcement comes from Washington that the largest independent has apprised the Defense Commission of its intention to add sufficient facilities to expand its annual ingot capacity by 850,000 tons or 8 per cent.

This decision follows weeks of discussion by the Defense Commission with steel producers on the need of immediate steps to enlarge the country's steel-making capacity. It will be a year before the additional facilities are expected to be in full operation, and their principal objective is to add to the supply of ordinary ship plate as well as armor plate, products in which this company is vitally interested because it has a ship-building affiliate. To the extent, therefore, of lessened pressure on the supply of raw steel for naval construction, consumers generally should benefit, once this additional capacity becomes operative.

Announcement by the leading steel producer that first quarter 1941 prices will remain unchanged from those now in effect contains the proviso that "prices will apply only on such shipments as are made up to and including March 31, 1941, and any shipment after that date will be billed at prices then in effect." Automobile manufacturers, according to what one hears in the steel market, have arranged for three-quarters of their 1941 model sheet requirements.

Confidence prevails that even if the national defense program four months hence should call for restrictions in the diversion of steel to civilian uses, a minimum of inconvenience will be caused. In some steel centers, sales executives professed to see a slight easing off in fresh demand during week ended Dec. 7. The American Iron and Steel Institute estimated the week's rate of mill activity at 96.9 per cent of ingot capacity, compared with 96.6 per cent in the preceding week, the rise being chiefly due to furnaces, down for repairs, being again in blast.

Although copper is being consumed at present at the annual rate of 1,300,000 tons while annual U. S. production is only 1,000,000 tons, the influence of the National Defense Commission's Price Division suffices to hold the market at the established 12-cent level. And this despite fresh agitation of Michigan mine owners to have the Government fix the metal's price at 16 cents a pound. A prominent brass manufacturer complained this week that "there is available to brass manufacturers less

New Truck Registrations

	October 1940	September 1940	October 1939	TEN MONTHS 1940	TEN MONTHS 1939	Per Cent Change, 1940 over 1939	Per Cent of Total Ten Months 1940	Per Cent of Total Ten Months 1939
Chevrolet	14,901	11,394	13,091	158,909	140,865	+ 13.0	33.20	34.53
Ford	14,380	10,804	7,694	133,285	105,045	+ 27.0	27.85	25.75
International	7,755	7,081	7,136	66,910	55,955	+ 19.8	13.98	13.71
Dodge	3,928	3,488	3,244	46,438	43,741	+ 6.0	9.70	10.72
G. M. C.	3,212	3,204	3,188	35,653	28,754	+ 24.0	7.45	7.05
Plymouth	588	434	515	8,177	7,621	+ 7.2	1.71	1.87
Mack	842	639	774	6,364	5,563	+ 14.3	1.33	1.36
White	588	551	455	5,604	3,865	+ 45.0	1.17	.95
Diamond T	601	530	570	5,491	4,382	+ 25.5	1.15	1.07
Willys-Overland	172	206	145	2,063	1,298	+ 59.0	.43	.32
Autocar	429	134	183	1,650	1,781	− 7.2	.34	.44
Divco	126	133	117	1,413	1,163	+ 21.3	.30	.28
Brockway	247	131	181	1,366	1,540	− 11.3	.29	.38
Federal	140	134	251	1,362	1,418	− 3.9	.28	.35
Studebaker	109	74	162	1,040	1,874	− 44.5	.22	.46
Hudson	49	34	10	624	366	+ 70.1	.13	.09
Reo	104	99	20	428	837	− 48.9	.09	.20
Bantam	9	18	55	327	501	− 34.7	.07	.12
Sterling	29	22	26	276	280	− 1.5	.06	.07
F. W. D.	26	18	9	223	146	+ 52.6	.05	.04
Miscellaneous	121	96	97	988	1,007	− 1.1	.20	.24
Total	48,356	39,224	37,923	478,591	408,002	+ 17.2	100.00	100.00

than one-half the amount of zinc needed to meet present requirements," and asks that zinc exports to Japan be stopped. If they are not, he said, there might not be enough zinc for die-cast automobile parts. The zinc market presents a sold-out condition and is likely to do so for some time to come. On the other hand two recent reductions in the price of lead wiped out sharp advances last month, the reductions being admittedly made because demand at the higher levels was inadequate. Arrivals of heavy tonnages of tin are keeping the market easy, spot Straits being offered at 50.20 cents a pound.—W. C. H.

"Futur-Liners"

The General Motors Parade of Progress takes to the road late this month in streamlined "Futur - Liners." Examining a model of one of the transports are (l. to r.) GM's J. M. Jerpe, C. A. Lewis, Paul Garrett and C. F. Kettering.

BOOKS . . . .

GRAPHICAL TREATMENT OF VIBRATION AND AIRCRAFT-ENGINE DAMPERS, *by C. H. Powell, Sc. D. Published by Bookcraft, New York.*

This book deals with vibration problems in machinery and employs the vector system of analysis. In the first part problems of complex vibrating systems are solved graphically by geometrically combining the more easily obtained solutions of simple systems. In the second part the methods developed in the first are applied to various types of torsional-vibration dampers. The various types of engine torsional-vibration damper are analyzed, their effects on the frequency and amplitude of vibration of the crankshaft system are investigated, and the optimum operating conditions determined. The book is highly mathematical and would appeal only to those with good mathematical equipment.

ELECTRICAL TROUBLE SHOOTING ON THE MOTOR CAR, *by A. H. Packer. Fifth edition. Published by the author at 8130 Harper Ave., Chicago, Ill.*

The new edition contains additional matter on voltage regulation. Explanations of current, voltage and combined current and voltage regulators are retained from the fourth edition. The new material includes explanations of the electrical control units on the 1940 Ford, Chevrolet and Plymouth cars, as well as a regulator trouble-shooting chart.

The book should be of considerable help especially to the novice in automotive electrical matters, because it gives simple explanations of electrical phenomena, using hydraulic analogies, and instruction on wiring, generators, starters, battery ignition, magnetos, test benches, storage batteries, armature and field testing, high-speed ignition, motor tune-up, motor testers, condenser testers, fuel pumps, gas analyzers and auto-radio noise prevention.

While electrical equipment of aircraft is not dealt with extensively, the principles which underlie such equipment are fully covered.

Ten Months Exports and Imports

	OCTOBER 1939		OCTOBER 1940		TEN MONTHS ENDED OCTOBER 1939		TEN MONTHS ENDED OCTOBER 1940	
	No.	Value	No.	Value	No.	Value	No.	Value
EXPORTS								
Automobiles, parts and accessories		$ 18,899,831		$ 22,531,285		$ 209,026,459		$ 203,900,684
PASSENGER CARS								
Passenger cars and chassis	9,318	5,842,470	6,388	4,529,608	115,562	70,910,575	71,891	45,506,272
Low price range $850 inclusive	8,108	4,582,401	5,093	3,247,593	103,018	57,686,655	63,172	36,450,758
Medium price range over $850 to $1200	985	916,618	1,168	1,101,676	10,720	10,183,921	7,587	7,201,593
$1200 to $2000	193	267,912	117	158,952	1,507	2,208,965	985	1,418,475
Over $2000	32	75,539	10	21,387	317	831,034	147	435,446
COMMERCIAL VEHICLES								
Motor trucks, buses and chassis (total)	8,655	4,661,029	9,752	7,431,471	94,907	58,474,943	83,126	69,350,944
Under one ton	1,381	517,710	1,169	519,102	14,197	5,909,367	10,751	4,912,425
One and up to 1½ tons	6,072	2,894,680	7,011	3,584,218	66,128	35,893,633	55,666	30,583,206
Over 1½ tons to 2½ tons	965	616,922	544	508,945	10,612	9,387,504	10,351	12,922,683
Over 2½ tons	203	589,667	1,004	2,790,135	3,357	6,718,121	6,165	20,676,319
Bus chassis	34	42,050	24	29,071	613	566,318	193	256,311
PARTS, ETC.								
Parts except engines and tires		3,822,440		6,274,581		33,672,245		43,459,316
Automobile unit assemblies		3,216,827		3,161,557		32,582,734		32,171,870
Automobile parts for replacement (n.e.s.)		458,644		477,520		3,481,839		4,248,740
Other automobile accessories (n.e.s.)		584,485		332,824		5,095,577		3,433,724
Automobile service appliances								
Airplanes, seaplanes and other aircraft (powered)	43	833,371	334	15,875,616	1,089	46,100,855	2,798	161,421,180
Parts of airplanes, except engines and tires (n.e.s.)		1,017,707		3,408,077		16,958,698		21,518,853
INTERNAL COMBUSTION ENGINES Stationary and Portable								
Diesel and semi-Diesel (other than automotive)	51	315,323	59	221,857	452	1,775,930	818	2,575,338
Other stationary and portable:								
Not over 10 hp.	1,916	93,466	948	60,908	12,815	728,233	11,922	686,987
Over 10 hp.	205	93,208	195	319,772	1,719	1,052,015	1,966	2,728,929
Engines for:								
Motor trucks and buses	2,324	259,781	1,024	111,880	22,724	2,773,909	15,686	1,760,155
Passenger cars	941	87,347	467	58,867	20,178	1,808,243	12,580	1,560,639
Aircraft	57	259,516	648	6,955,332	1,355	9,443,221	3,985	37,865,890
Accessories and parts (carburetors)		255,510		318,603		2,416,017		3,851,531
IMPORTS								
Automobiles (dutiable)	73	67,306	37	49,174	527	402,109	505	503,633

Three Natural Gas Engines Announced by Caterpillar

Three new models of heavy-duty natural gas engines have been announced by Caterpillar Tractor Co., Peoria, Ill. Model 4600G is a six-cylinder unit and the 4400G is a four. Both of these engines have a bore of 4¾-in. and a 5½-in. stroke and they develop 74 hp. and 48 hp., respectively, at 1600 maximum governed r.p.m. A small four, Model 3400G, with a bore and stroke of 3¾ in. by 5 in. develops 34 hp. at 1650 r.p.m.

All are of valve-in-head design. An upper-cylinder lubricator provides extra valve lubrication for use with dry natural gas fuel.

DuPont Further Increases Neoprene Plant Capacity

E. I. du Pont de Nemours & Co., has started construction on a further addition to its neoprene plant at Deepwater, N. J. The new section is expected to be completed by October, 1941, and will be equivalent in size to an addition just completed. Together, the new facilities will give the company a capacity of 1,500,000 lb. per month, nearly six times the capacity available in the summer of 1939.

Training

(*Continued from page 651*)

work two hours early on Friday when 18 men in the panel assembly department quit work after a shop steward had been sent home for allegedly ordering a slowdown. The dispute centered on the layoff of six workers in the department due to a reduction in production schedules. The slowdown was repeated in the panel assembly department on the night shift and the men walked out, disrupting the flow of material in the rest of the plant and sending 5000 workers home.

A consequent shortage of bodies compelled Plymouth to close down, making 10,000 workers on two shifts idle. A three-hour conference attended by Dewey, W. P. Brown, president of Briggs; R. J. Thomas and Richard Frankensteen, president and vice-president of the UAW-CIO, produced the settlement and work resumed at both the Plymouth and Briggs plants on Monday.

The 12-day strike at the Los Angeles plant of the Vultee Aircraft Corp. came to an end Nov. 26, returning 5200 employes to their jobs and resuming production on $84,000,000 in government orders. Dr. John R. Steelman, chief of the Department of Labor's conciliation division, and Thomas were instrumental in settling the strike, which granted an estimated $1,262,306 in raises to 3700 production workers.

Negotiations for a revised contract between the Chrysler Corp. and the UAW-CIO began Nov. 25 at the Chrysler Highland Park plant, but no reports were made on the progress of negotiations. Richard T. Frankensteen headed the union negotiators.

Five thousand employes of the Murray Corp. of America have received approximately $223,000 in vacation premiums under the terms of an agreement between the UAW-CIO drawn up last June. The vacation bonus was on a sliding scale and provided for payment of three per cent of a worker's earnings in the firscal year ending Aug. 31, 1940, if net profit in that period exceeded $900,000. Net profit for the fiscal year ending Aug. 31 totaled $856,870 after provision for the maximum bonus of three per cent.

Bearing Loads

(*Continued from page 639*)

Figs. 3 to 11, inclusive, show three different arrangements of universal joints with respect to bearing supports, and the diagrams serve to determine the loads on the various bearings (and the bending moments on the intermediate shaft) for various critical positions. In Figs. 3, 4, and 5, and 9, 10, and 11, universal joints with centering-type spiders are considered, while in Figs. 6, 7, and 8, the reference is to joints with non-centering spiders. All figures of couples, bearing loads, etc., are based on an input torque of 100 lb.-in.

MEN . . . . . .

W. C. Williams, Jr., Frederick C. Kroeger and **Edward F. Fisher** have been elected vice-presidents of General Motors Corp., New York. Mr. Williams is on the staff of C. E. Wilson, acting vice-president, as assistant in charge of the manufacturing section in Detroit; Mr. Kroeger is general manager of the Allison Division, Indianapolis, and Mr. Fisher is general manager of Fisher Body Division, Detroit.

Ogden Phipps, a partner in Smith, Barney & Co., has been elected to the board of directors of Electric Auto-Lite Co., Toledo, Ohio. Mr. Phipps is also a director of International Paper & Power Co., International Paper Co., Seaboard Oil Co. of Delaware and Cerro de Pasco Copper Co.

A. B. Morey, for the past four years treasurer of the Gisholt Machine Co., Madison, Wis., has been elected a vice-president. **H. J. Homewood** succeeds Mr. Morey as treasurer. **C. K. Swafford**, general superintendent, was elected to the board of directors.

Noise Sleuth

To aid in locating and isolating troublesome noises within cars, engineers at the Ford laboratory use the vibration pickup and analyzer shown here. It measures vibration velocity, thereby helping to locate a vibrating part.

Stockholders of the United Specialties Co., Chicago, recently reelected the following directors: **John T. Beatty, M. D. Harrison, J. C. Markey, Russell Maguire, Eugene D. Powers** and **Reginald N. Webster.** Officers also reelected for the current fiscal year are: **John T. Beatty**, president; **M. D. Harrison**, secretary and treasurer, and **A. Vander Meulen**, assistant secretary and treasurer.

Constantin Chilowsky, formerly of Paris, is now in the United States on a permanent basis. Mr. Chilowsky is the inventor of the "Photo Relay Chilowsky," which was described on pages 890 and 891 of AUTOMOTIVE INDUSTRIES, Dec. 26, 1936. His research and development activities during the past 20 years have included numerous inventions in the automotive field, particularly in connection with Diesel engines.

Paul L. Gillan, formerly with Lycoming Mfg. Co., H. H. Franklin Co. and American LaFrance Co., has joined the industrial engineering consultation staff of Aluminum Industries, Inc., Cincinnati, Ohio.

Donald A. Robinson has been advanced from general sales manager to vice-president in charge of advertising and selling activities for Caterpillar Tractor Co., Peoria, Ill. **Gail E. Spain** succeeds Mr. Robinson as general sales manager. **Bill Rogers** has relinquished his office of general factory manager to retire. That office has been discontinued, and factory managers now report direct to **T. J. Connor**, vice-president.

L. B. Keeler has resigned his connection with Hudson Motor Car Co. to join the Wayne Division of Bendix Aviation Corp., Wayne, Mich., in charge of production planning and material control.

Stewart W. Monroe has been named general sales manager of the Chrysler Sales Division, Chrysler Corp., Detroit.

Gaylord G. Thompson, formerly with Gisholt Machine Co., Madison, Wis., has

Truck Production by Capacities

(U. S. and Canada)

CAPACITY	TEN MONTHS				
	Units			Per Cent of Total	
	1940	1939	Per Cent Change	1940	1939
1½ Tons and less	618,723	549,515	+ 12.7	88.63	91.60
2 to 3 Tons	47,208	28,553	+ 65.5	6.76	4.76
3½ Tons and over	13,266	11,350	+ 16.8	1.91	1.89
Special and Buses	6,626	5,034	+ 31.8	.95	.84
Station Wagons	12,246	5,434	+126.0	1.75	.91
Total	698,069	599,886	+ 16.1	100.00	100.00

been appointed tool engineer for the McKenna Metals Co., Latrobe, Pa.

John M. Spangler, general sales manager of National Carbon Co., Inc., New York, has been made a vice-president of the company.

Joseph Mattson, formerly director of the California Department of Motor Vehicles, has been appointed to the field staff of the Automobile Manufacturers Association. He will represent the association in western states as a member of the field relations department.

Claude E. Murray is the new vice-president and general manager of the Willard Storage Battery Co., Cleveland, Ohio. For the past 11 of his 30 years with Willard he has occupied a similar office with the company's Canadian affiliate in Toronto.

J. H. Mack, formerly vice-president of Chrysler Corp.'s Fargo Division, has been named general service manager of the corporation's Central Service Division, replacing **H. J. Nestle,** resigned.

H. E. Beyster, for the past 20 years with General Motors as building designer, has purchased the interests of **C. A. Handeyside** and **John Earnshaw** in the C. A. Handeyside Construction Co., Detroit. **Mr. Beyster** is president and general manager of the new company, to be known as Beyster Corp. Many National Defense building contracts, including Packard's new Rolls-Royce engine plant, have already been started by the new company.

Edwin H. Armstrong, professor of electrical engineering at Columbia University and pioneer in the field of "frequency modulation" radio circuits, received the Holley Medal of the American Society of Mechanical Engineers on Dec. 4 at the society's annual dinner in New York.

James Work, as chairman of the board, heads a new line-up of officers at Brewster Aeronautical Corp., Newark, N. J., which includes **George F. Chapline,** formerly of Wright Aeronautical Corp., as president; **William L. Smith,** formerly of Western Electric Co., as vice-president in charge of material, and **Dayton T. Brown** as vice-president in charge of experimental research and development.

Coincidental with the setting up of a new division devoted exclusively to automotive finishes, the Sherwin-Williams Co., Cleveland, has announced the appointment of three new zone managers for the division. They are **C. E. Smith,** Philadelphia, **R. R. Owens,** Cleveland, and **R. C. Hall,** Little Rock, Ark.

R. A. Travisano has succeeded the late **H. T. Smith** as traffic manager of the Worthington Pump & Machinery Corp., Harrison, N. J.

Patriotic Button

Conceived by Jay O. Lasher, director of advertising, American Chain & Cable Co., New York, this post-election, all-party button is being manufactured by Parisian Novelty Co., Chicago. All royalties are being donated to the Red Cross.

PUBLICATIONS

Complete descriptions of construction as well as cross-sectional photographs of the line of **gasoline hose for tank truck and tank car service** made by the B. F. Goodrich Co., Akron, Ohio, are contained in a new catalog sheet issued by the company.*

Link-Belt Co., Chicago, has completed an 88-page data book, No. 1775, designed for the use of all who have occasion to use, recommend and buy **bearings and other power transmission equipment.***

Technical data of interest to the engineer and buyer of steel plates is included in the publication **"Lukens Steel Plates",** issued by the Lukens Steel Co., Coatesville, Pa.*

An illustrated folder, entitled "Dirt is a Critical Hazard", has been published by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. It describes the application, operation, and dirt removing qualities of the **Precipitron electrostatic air cleaner** manufactured by Westinghouse.*

Two new **fluorescent lighting** developments of particular interest to industry, the Ivanhoe "Masterlite" and the "50-Foot Candler", are covered in two new pamphlets published by the Miller Co., Meriden, Conn.*

The National Highway Users Conference, Washington, D. C., has issued an illustrated pamphlet entitled **"Our Highways and the Nation's Defense".***

The **"HD-7" Diesel crawler tractor,** built by the Allis-Chalmers Mfg. Co., Milwaukee, Wis., is the subject of a new catalog. Written in conversational tone and simulating a letter, the whole catalog is printed in typewriter type.*

Palmer Bros. Engines, Inc., Cos Cob, Conn., has brought out a new catalog covering its line of **marine engines.***

River shippers and those contemplating the use of **inland waterway transportation** will find a convenient summary of information on the Allegheny, Monogahela, and the upper Ohio rivers in a bulletin prepared by the Union Barge Line Corp., Pittsburgh, Pa.*

"The Zinc Industry—A Mine to Market Outline" is the title of a booklet by Ernest V. Gent, secretary, American Zinc Institute, Inc., New York.*

Wm. F. Klemp Co., Chicago, recently published a new catalog covering its line of diamond grating, steel stair treads, Hexteel Heavy Duty Surface Armor, and Klemp-Acme Floorsteel.*

* Obtainable through editorial department, AUTOMOTIVE INDUSTRIES. Address Chestnut and 56th Sts., Philadelphia. Please give date of issue in which literature was listed.

MEN and MACHINES

(*Continued from page* 643)

tion, 12 ft. 3 in. between housings. It is equipped with a fluorescent light bear shearing gage, hydraulic holddowns, micrometer ball bearing back gage, and four-edge solid one-piece knives.

A NO. 1-F Fastermatic machine now being built by the Foster Machine Co., Elkhart, Ind., is entirely new in design, and of similar construction to the new No. 2-F Fastermatic that was announced by the company a few months ago. The new model has a regular range of 27 spindle speeds from 22 to 332 r.p.m. These are arranged in nine sets of three automatic changes. Any group of these automatic changes may be obtained by a proper set of pickoff gears. Higher ranges may be had when required.

Some of the principal dimensions of the machine are as follows: Swing over bed, 21 in.; total distance of spindle nose to turret face, 41 11/16 in.; weight, approximately 7000 lb.; floor space, 40⅝ in. by 122 in. The manufacturer claims that with the entire feeding mechanism of this machine hydraulically operated, fully 75 per cent less moving parts are required than on any other machines for similar purposes equipped with gear, cam or screw feeds; and at the same time, a greater feeding range is available.

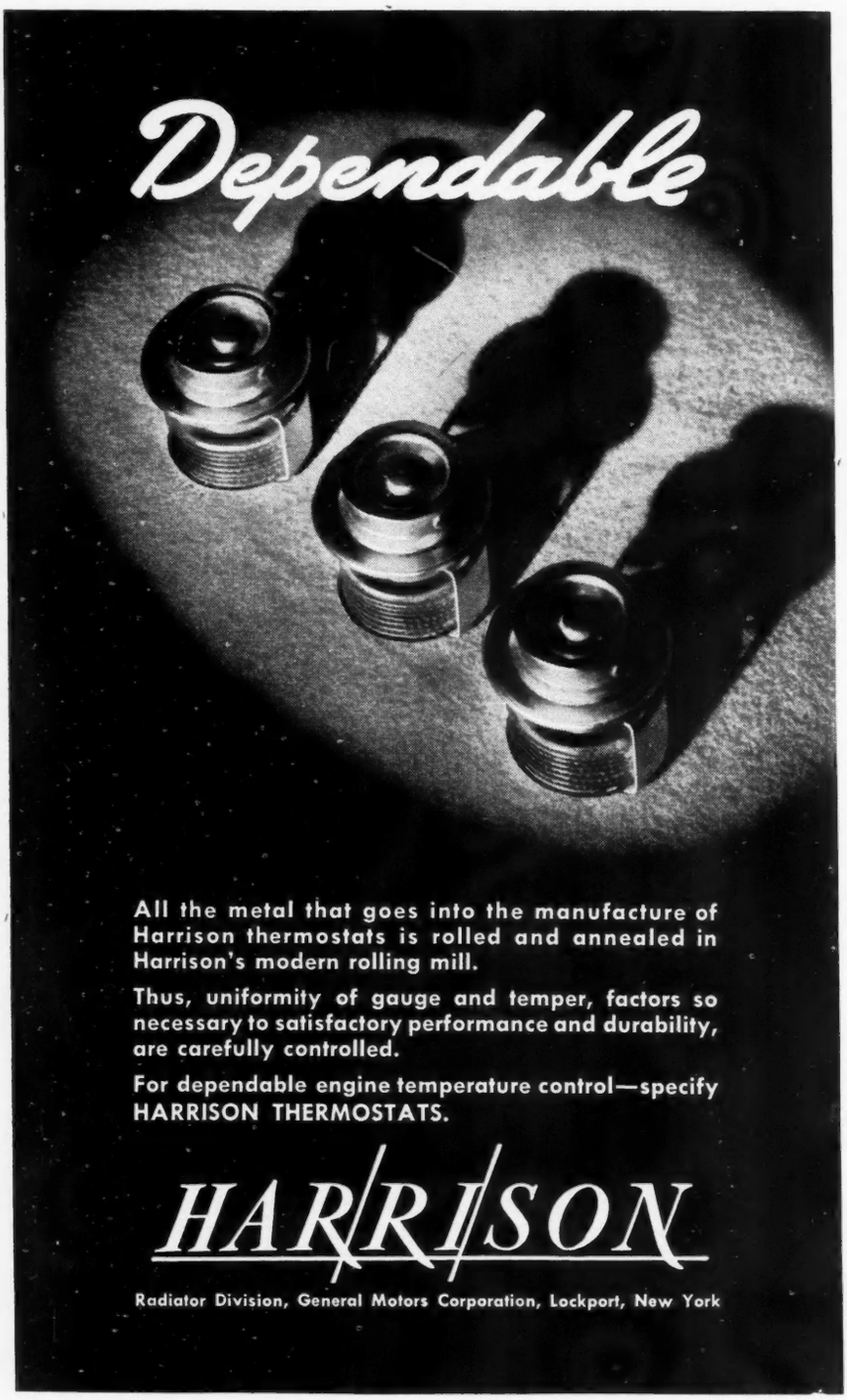
A RECESSING, boring and tapping machine now being manufactured by the Landis Machine Co., Waynesboro, Pa., is on page 643. It has been designed to machine completely the internal or tapped end of integral joint type casing at one chucking. The equipment is similar in design to the Landis Mill type receding chaser pipe threading and cutting off machine. However, with this machine the conventional carriage and receding chaser pipe threading die head were replaced with a special carriage on which is mounted the recessing, boring and tapping tools. In effecting this arrangement, three tool slides are mounted on a cross slide which can be indexed to bring any one of the tool slides into

working position. One tool slide finishes the recess, faces the end of the casing, and chamfers three surfaces in the end of the casing. The three chamfers referred to are, one inside and one outside chamfer on the extreme end of the casing, and one chamfer at the inside end of the recessed surface.

The second tool slide finishes the taper bore preparatory to tapping, using a receding action to the cutters for accurately producing the taper. A tool of a design similar to the Landis receding chaser collapsible tap is employed for the boring operation. Upon completion of the boring operation, the cutters are collapsed to permit withdrawing of the tools without scoring or marring the finished bored surface.

The third tool slide is a special Landis receding chaser collapsible tap arranged to chase the internal threads using the leadscrew mechanism which is built into the machine and which provides the accuracy in thread lead required by the Standards of the American Petroleum Institute.

All movements of the tool slides as well as the cross slide are controlled hydraulically with the circuits arranged with interlocks to assure correct operating sequences. The cross slide is locked hydraulically into position on the carriage when any one of the tool slides is in action. The operating controls for this hydraulic cycle are conveniently centralized on a panel at the front of the machine, providing the operator full control from a position permitting the observation of the tools in action during the machining cycle.


Dependable
All the metal that goes into the manufacture of Harrison thermostats is rolled and annealed in Harrison's modern rolling mill.
Thus, uniformity of gauge and temper, factors so necessary to satisfactory performance and durability, are carefully controlled.
For dependable engine temperature control—specify HARRISON THERMOSTATS.
HARRISON
Radiator Division, General Motors Corporation, Lockport, New York

THE large straightening press (shown on page 643), built by Hannifin Manufacturing Co., Chicago, has a capacity of 150 tons and is provided with a large table, to facilitate straightening of steel castings and similar work. The base of the press is designed for installation below floor level, to bring the table to a convenient height for easy handling of bulky pieces.

Hannifin sensitive pressure control is used, allowing simple and accurate handling. The operation of this type of control allows rapid handling of straightening operations, with fingertip or light pressure pedal control of the ram movement and ram pressure. Ram movement, both up and down, and pressure control are accomplished by means of the single hand lever or pedal.

The motor driven hydraulic power unit is built into the base of the press. Press frame is welded, and all piping is concealed. Dimensions are: Stroke 20 in.; gap 30 in., reach 30 in., table 54 by 96 in.

THE Fisher motorized nose pour crucible furnace (shown on page 642), is especially adapted to melting aluminum and magnesium metals and features a constant pouring arc. The pouring lip has been brought to the center of pivot by mounting the furnace on trunnions with axes in line with the lip. Models of this furnace, especially adapted to aluminum melting, are modified to provide against porosity of metal produced. The furnace is adapted further to pouring ingot and permanent molds, transfer ladles, and bearing metals. In ingot pouring, molds can be conveyed to the point of pouring on either turn table or movable rack carriers. Permanent molds may be mounted on turn tables and poured direct from furnace. Transfer ladles can be spotted below the pouring lip of the furnace and remain fixed throughout the entire pouring operation. Bearing metals are poured direct to molds. The Fisher Furnace Co., Chicago, builds this equipment in standard sizes for 150 crucibles and up.

HARDINGE BROTHERS, INC., Elmira, N. Y., has discarded the term "Hand Screw Machine" and calls its latest model the "High Speed Precision Second Operation Machine." Second operation work is performed in almost every plant engaged in the manufacture of a modern precision product. Secondary operations, in many cases, are the final finishing or exact sizing operations performed on a partially completed part. Features claimed by Hardinge to make its new machine especially adapted to second operation work are: enclosed head with preloaded ball bearing spindle construction; elec-

trical driving unit with multi-speed motor, eliminating all gears, clutches and loose pulleys; convenient lever speed control at the headstock of the machine; and, an all welded, all steel pedestal.

The Hardinge high-speed second operation machine has a one-inch collet capacity, six-inch step chuck capacity and nine-inch swing.

TUTHILL SPRING CO., Chicago, recently installed new equipment for making its highway guard rail. Material for the guard rail is brought from the steel mills in hot rolled strips, 12⅝ in. wide by No. 9 gage. First operation is to punch four holes at one end, and four slots at the other end of each panel. Panels then are formed in a roll stand, which gives the panels their convex shape. A photograph of the entering side of the rolls is shown on page 643.

After the panels come out of the forming rolls they pass through two steel wire brushes which brush off all loose scale. The rail panels then are painted and stacked to dry.

GREENERD ARBOR PRESS CO., Nashua, N. H., will put two new presses on the market on Jan. 2, 1941. One of these is designated as the No. H-70 self-contained press. Pressure is variable from six to 30 tons on the down stroke. The working table of the press is 18 in. wide, 15 in. deep, with a 3½-in. cored hole central with the ram.

Rapid traverse speed of ram up to 15 tons pressure is available at the rate of 138 in. per min., with instantaneous change-over to a working speed of 38 in. per min. within the range of 15 to 30 tons pressure. The press receives up to 22-in. diameters. Height over working table is 14 in. Stroke of ram is adjustable from one to 10 in.

The other press is a 30-ton pull type, designated as the No. H 70 P.

THE new 12-spindle continuous type Superfinisher (shown on page 643), was built by the Foster Machine Co., Elkhart, Ind., and is arranged to perform the Superfinishing operation on valve tappet bodies for a leading automotive manufacturer. The cycle of the machine is fully automatic. Each work spindle is equipped with a centerless drive, wherein the body of the tappet is rotated by the use of a pair of rolls. Each work spindle is equipped with a Superfinishing head. As each spindle approaches the unloading station after the completion of the Superfinish operation, the Superfinishing head automatically raises and the r.p.m. of the work spindle then comes to a stop. The tappet is removed and another is placed into the centerless drive. The Superfinish head then descends to the work as the r.p.m. of the spindle starts. The table of the machine is continuous in rotation. All that is required on the part of the operator is the unloading and loading of the new part when the Superfinishing head is in its upward position and the spindle has come to a stop.

Production of the machine when arranged for tappet body is approximately 900 parts per hour.

Publications Available

Bulletin VBS-40, covering its line of "Senior" **presses,** has been issued by the Colonial Broach Co., Detroit. The machines are completely hydraulic in operation and are designed for general purpose work, including assembly, straightening and broaching.*

Lapping and polishing compounds produced by the National Broach & Machine Co., Detroit, are discussed in a leaflet issued by the company.*

The **Six-Inch Type C Grinder** built by Norton Co., Worcester, Mass., is the subject of a recently issued leaflet.*

"Drilling, Boring and Tapping in the Aviation Industry" is the title of a booklet prepared by the National Automatic Tool Co., Richmond, Ind.*

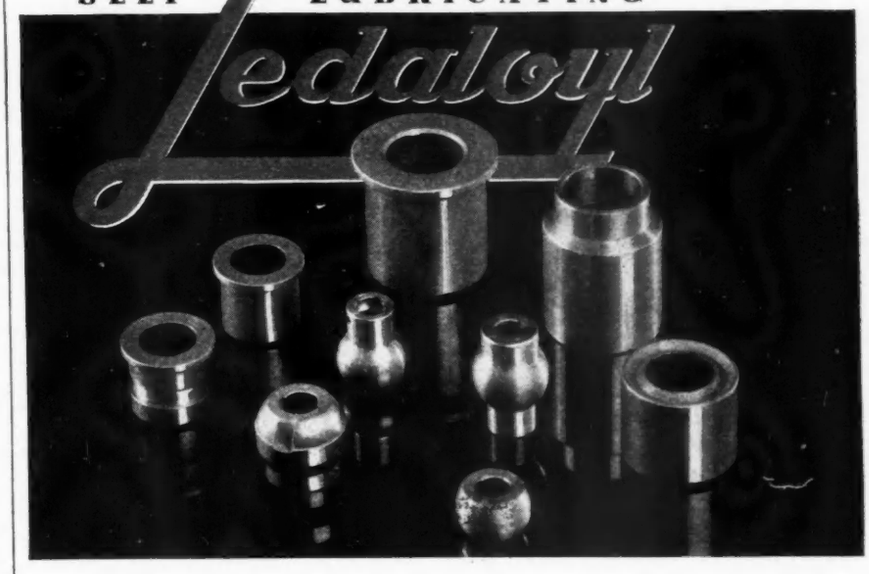
A new broadside brought out by the Exact Weight Scale Co., Columbus, Ohio, bears the title **"The Story of Modern Industrial Weighing."***

Catalog section 61-150 prepared by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., is devoted to the **"Tufflite Concentrator"** floodlighting unit designed for use with 300 or 500 watt type PS-40 lamps.*

Various types of **cut-off wheels** made by Norton Co., Worcester, Mass., are described in a booklet issued by the company.*

Bulletin 117 issued by the Lyon Iron

SELF LUBRICATING



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JOHNSON BRONZE

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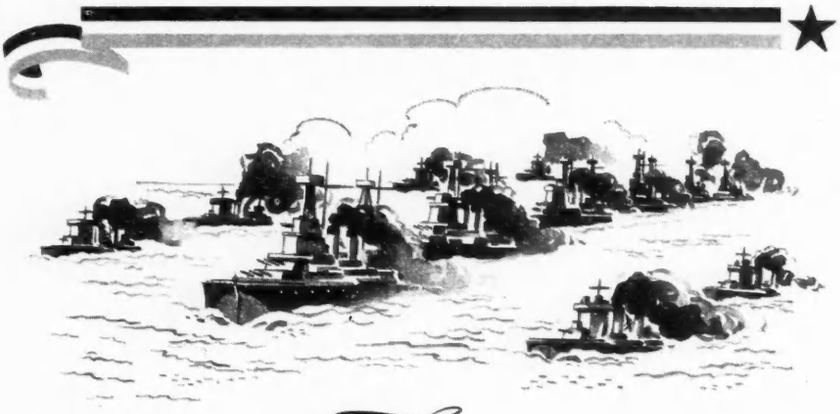
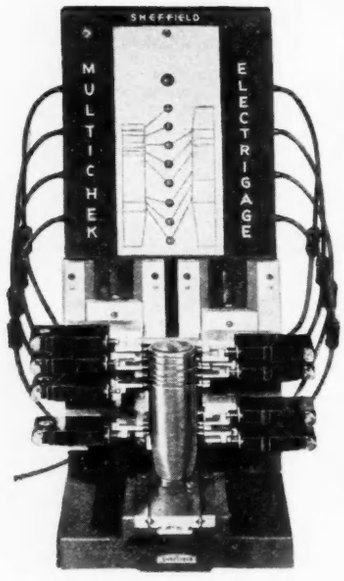


They SHALL NOT PASS

Unless every one of the eight critical dimensions of this 75 mm. shell checks within prescribed limits, it does not pass this guardian of quality. Six hundred an hour of these shell bodies are thus checked on the Sheffield Multichek Electrigage pictured at the left. In a flash the inspector knows whether each shell body is acceptable or not.



The slightest variation beyond tolerance limits is flashed by a colored signal light on the control board above the Electrigage head. The color of the light indicates whether the dimension is oversize or undersize. And the position of the colored flash indicates just which dimension or dimensions are incorrect. If all dimensions are correct the master signal at the top of the board so indicates. Then it is unnecessary to read individual signals.

If your problem is rapid, accurate inspection of multiple dimensions on a wide variety of parts without eye strain, write for particulars on the Sheffield Multichek Electrigage.

★ ★ ★ SHEFFIELD GAGE CORPORATION • DAYTON, OHIO, U.S.A. MASTER GAGEMAKERS ★ ★ ★

Works, Greene, N. Y., deals with the firm's new **hydraulic lift truck, pallet type, for** both double faced and single faced pallets.*

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has published a booklet (Descriptive Data 26-100) containing useful facts about **welders** and their operation.*

A 16-page engineering bulletin devoted to the machining of steels with **cemented carbide tools** has been released by the Carboloy Co., Inc., Detroit. The new bulletin (GT-123) covers tool design and selection; use of coolants; chip breaker design and use; grinding of chip breakers; machine maintenance design and equipment consideration; tables covering feeds, speeds, depth of cut and grade selection for different types of steels; formulas for calculating horsepower requirements, etc. It also contains a supplement covering, in tabular form, recommendations for machining cast iron, nonferrous, and non-metallic materials.*

A folder, published by the Pier Equipment Mfg. Co., Benton Harbor, Mich., contains data on this company's manually-operated and automatic Ace **spot welders.***

Steel boxes for facilitating the handling of small parts in production and assembly are described in Catalog 184 brought out recently by the All-Steel-Equip Co., Inc., Aurora, Ill.*

A bulletin, issued by the American Manganese Steel Division of the American Brake Shoe & Foundry Co., Chicago Heights, Ill., covers Amsco-Nagle **industrial pumps** "for pumping everything but clear inactive liquids."

"Light Where You Want It—Plus Protection" is the title of a catalog released by the Boyer Campbell Co., Detroit. Applications of Marvel Shields to stationary grinders, disk sanders, surface grinders, band filers, shapers, metal band saws, milling machines, universal tool and cutter grinders, mortising saws, lathes, etc., are described.*

Norton Co., Worcester, Mass., has published a booklet bearing the title **"The Construction of Electric Furnaces for the Laboratory".***

A new Kennametal **tool room chart** (No. 6), on which has been printed an inch rule and a protractor for measuring tool dimensions and angles, has been issued by McKenna Metals Co., Latrobe, Pa.*

The Brown Instrument Co., Philadelphia, Pa., has brought out a new catalog, No. 6706, covering its rectangular case **thermometers and pressure gages.***

The Barber-Colman Co., Rockford, Ill., has published recently the following folders: "Paraform Cutters for Your Milling Machines"; "Type T Taper Spline Hobbing Machine"; "Inspection Streamlined"; "Special Units and Accessories for No. 3 Hobbing Machines".*

A new illustrated booklet, describing the type RQ Photo-Troller and its accessories, has been announced by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. The RQ Photo-Troller is a general purpose **photo-electric relay** for operation on 115 volts indoor service.*

Descriptive details covering an **explosion proof switch** of the roller arm type for actuation by cams and slides are contained in a data sheet prepared by the manufacturers, the Micro Switch Corp., Freeport, Ill.*

A new Red Ring **gear grinding machine,** built by the National Broach & Machine Co., Detroit, is the subject of a pamphlet just released.*

Bulletin 740 now being distributed by Stephens-Adamson Mfg. Co., Aurora, Ill., deals with the company's Sealmaster Style "A" extended inner ring **bearings** in fractional inch dimension bores.*

An **electrode selector chart** for use by arc welding operators has been prepared by Air Reduction, New York, N. Y.*

Sheffield Gage Corp., Dayton, Ohio, has published a brochure, entitled "Sheffield Gages", covering the design, construction and application of its line of **precision gages.** Considerable data on standards and constants useful in inspection work are included.*

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* Obtainable through editorial department, AUTOMOTIVE INDUSTRIES. Address Chestnut & 56th Sts., Philadelphia. Please give date of issue in which literature was listed.

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NATIONAL TUBE COMPANY

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UNITED STATES STEEL

"Little Business" Gets the Green Light from Washington

(*Continued from page* 618)

"The primary program will use the 'farming out' method," Mr. Hillman said. "This is an efficient means of dividing work. The work under this program will be broken up among the plants, diversifying the industries in each area. Production and employment will be fairly distributed thus emphasizing cooperation in an integrated program."

As an illustration of the widespread results of the sub-contract program, the commission has announced a breakdown of the contracts already let by one major aircraft company. The list includes products from manufacturers in 30 states. The materials bought range from ignition cable from Rhode Island, through pumps and valves made in Ohio, to anchors and exhaust manifolds in California. The commission has mailed to 500 firms working on defense orders a special list of idle plants and equipment to aid defense contractors to speed up deliveries. An interesting practice of small towns in handling large defense orders is to "pool facilities" among the different plants in such towns. The practice is said to have originated in York, Pa., a town of unusually widely diversified plants, considering its size.

In his work to revitalize "ghost towns" Mr. Hillman surveys the labor situation and makes known the types and volume of workers available for defense production.

Mr. Cooke, who says he learned from Herbert Hoover that "too many surveys and too much reconnaisance" are to be avoided, explained that government investigators were sent to 15 selected towns to gather information on idle plant capacity and that by limiting the number in the sampling "we learned practically all we need to know about the problem."

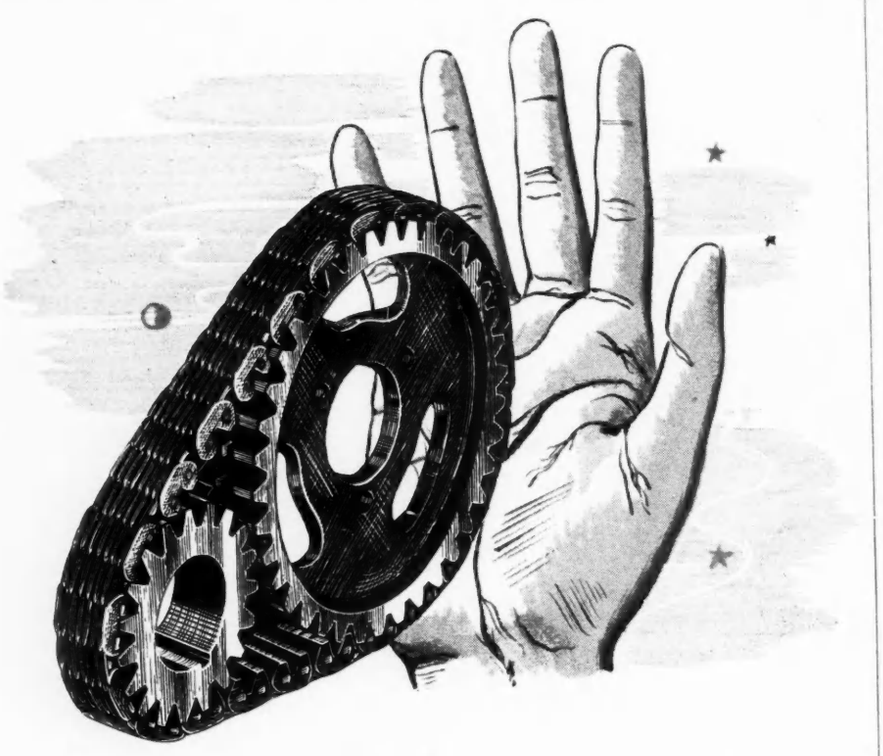
"Developing the farming out process (in defense program) aids democracy," Mr. Cooke told AUTOMOTIVE INDUSTRIES. "It's a democratic way—a new phase of democracy in defense work."

Although the program is in its embryonic stage, the plan is to send out to selected communities drawings and specifications indicating the types of work which the government is anxious to "farm out." The War and Navy Departments are cooperating in the work.

Mr. Cooke's job is to promote community organization so that a town's idle industrial facilities can find their place in the defense picture by making their facilities available to larger companies with defense orders. Behind these efforts are these objectives: To keep communities intact by discouraging the migration of workers; to direct defense work to the community and thereby encourage employees to maintain long-established residences; and above all, Mr. Cooke emphasizes, to get them to "stand on their own feet."

One phase of the program not being overlooked is the long-range effect when the defense emergency has passed and the country attempts to "snap back" into peacetime pursuits. In this respect, the plan is to encourage the diversification of industry on the theory that such a trend will contribute immeasurably to a stable peacetime economy.

Results of the program in terms of orders placed with particular plants are nothing to boast about thus far. But in getting the idea under way, government sponsors, according to Mr. Cooke, are not losing sight of the fact that "the only proper way to mobilize is to plan for demobilization in an orderly fashion."



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